PAGE'S WEEKLY.—April 14, 1905. Thin Paper Copy for Circulation Abroad.

No. 31. Vo 6.

SIXPENCE.
(Registered as a Newspaper.)

FRIDAY,
APRIL 14, 1905.

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# PAGE'S WEEKLY

## ENGINEERING · ELECTRICITY
## SHIPBUILDING ⁂ MINING
## IRON & STEEL INDUSTRIES

EDITORIAL & PUBLISHING OFFICES, CLUN HOUSE, SURREY STREET, STRAND, LONDON, W.C.

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Let me know the amount of water you require and I shall be pleased to quote.

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*Sole Speciality since establishment in 1855 of*

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BERLIN N.20, GERMANY.

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FOR NOISELESS MOTOR DRIVES.

**MACHINE-CUT GEARS**
OF ALL DESCRIPTIONS.

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HAND OR POWER
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The Sole
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Best
English Steel
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WORKS:
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# PAGE'S WEEKLY Miscellaneous

**Mr. G. H. HUGHES, M.I.Mech.E.,**
Consulting and Organising Engineer for Water Works and Industrial Undertakings,
97, QUEEN VICTORIA ST., LONDON, E.C.
Telephone No.: 5754 Bank. Write for particulars.

**WEST PASCAGOULA CREOSOTING WORKS,**
WEST PASCAGOULA, MISS., U.S.A.

Situated on Pascagoula Bay and on the line of the Louisville and Nashville Railroad. These works have been in operation for more than twenty-six years. ORDERS for Creosoted Piles, Telegraph Poles, Cross Arms, Electric Conduits, Paving Blocks, Sawed Tiles, and Timber PROMPTLY EXECUTED. New cylinders, 115 ft. long. Capacity, one million feet per month. A.B.C. Code used. Cable address: Pierre, West Pascagoula, Miss.—Address, JNO. B. LINDSEY, Superintendent.

**"UNICA" SILENT GEARS**
Equal in STRENGTH to, and MORE DURABLE than, Cast Iron, Gun Metal, or Rawhide.
NO SIDE PLATES OR BUSHES! UNAFFECTED BY OIL!
Have stood test of four years.
**J. B. HAMILTON & CO.,**
Telegrams: "Verdampfer, London." 145, Cannon St., LONDON.

**ED. BRAND,** *MECHANICAL ENGINEER,*
35, SHAKESPEARE STREET, MANCHESTER.
**Modern Wire-Working Machinery,**
Such as for Rolling, Drawing, Weaving, Netting, Forming, Automatic Straightening and Cutting, Cabling, Testing, &c.
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*Second Edition, Revised. Price 7s. 6d.*

DEPRECIATION OF FACTORIES, Mines, and Industrial Undertakings, and their Valuation. With Tables and Examples.
By EWING MATHESON, M.Inst.C.E.

The Principles which should guide the Writing off for wear and tear, Obsolete plant; Terminable or wasting properties; Effect on Income-tax; Value defined as for Compulsory purchase; Going concern, or dismantled; Rateable value, rental value.

"A successful attempt to systematise existing information and to make it possible to arrive at uniformity and accuracy in making up balance sheets for valuations. The work is unique of its kind."—*The Engineer.*

E. & F. N. SPON, 125, Strand, London.

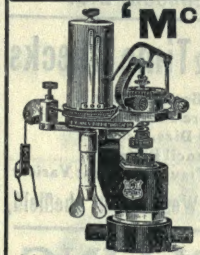
JOSEPH BOOTH BROS., LTD., RODLEY, LEEDS. See next week.
**LIFTING MACHINERY.**

THOS. W. WARD, ALBION WORKS, SHEFFIELD. See Page 19.
**MACHINE TOOLS.**

THE SHANNON, LTD., Ropemaker St., London, E.C. See Page 78.
**OFFICE APPLIANCES.**

Have you seen our Advertisement on page ~~69~~ 51. A glance at it may save you £500 per annum.—
ED. BENNIS & CO., Ltd., BOLTON.

**PAGE & ROWLINGSON,**
**Chartered Patent Agents.**
Mr. PAGE, who is a Whitworth Exhibitioner and an Associate Member of the Institute of Civil Engineers, has had a large experience as a Practical Mechanical Engineer, and is specially qualified to deal with the most intricate mechanical problems successfully. *Write for Handbook of Information Free.*
28, NEW BRIDGE STREET, LONDON, E.C.,
And 14, St. Ann's Square, Manchester.



**'McINNES-DOBBIE' INDICATORS.**
In Two types: External and Enclosed Pressure Springs.
Each made in several forms and sizes to suit all speeds and pressures.
Special Indicators for Gas, Winding, and Ammonia Engines, and for Motor-Cars.
Adopted by the British, French, and Japanese Admiralties.
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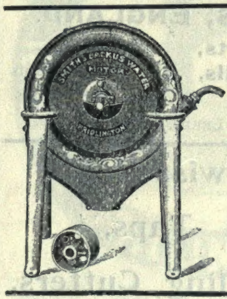

**CHEAP POWER.**
SMITH'S
**Backus Water Motors**
1/16 to 10 H.P.
Will drive any class of Machinery, and work on 15 lb. pressure.
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See our Advertisements in last and next week's Issues.

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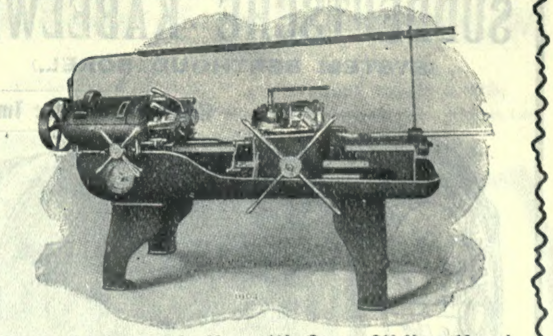
**FLAT TURRET LATHE**



The only Turret Lathe with Cross-Sliding Head.
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"JUBILEE BUILDINGS,"
97, Queen Victoria Street, LONDON.

# PAGE'S WEEKLY Miscellaneous

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Marks, Name Stamps, Branding Irons, Sets of Letter and Figure Punches, Embossing Presses and Dies, Seals, Brass Name Plates, Stencil Plates, Moulders' Letters and Figures in Great Variety.

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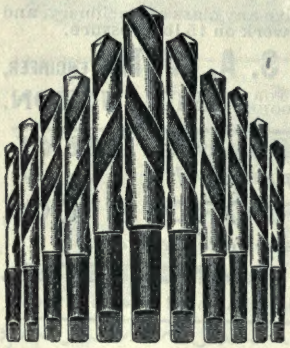
Telegrams: "LEGATION, LEEDS."



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VERTICAL STEAM BOILERS

Apply for Catalogue.

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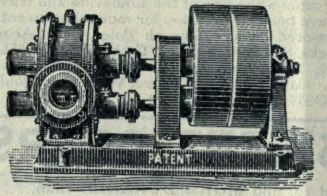

Best of all Systems for all Liquids.

4,000 Pumps under my System (with a capacity up to 15,000 litres per minute) in use.

**ENKE'S PRECISION BLOWER.**

Entirely of Iron without packing for high pressures to 0·3 atm.

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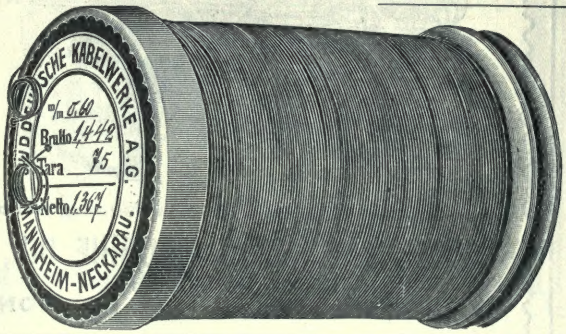

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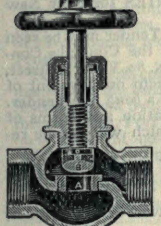
TELEPHONE CABLES.
With Paper and Air Insulation.

LEAD COVERED CABLES
For all Tensions up to 40,000 volts.

# PAGE'S WEEKLY Miscellaneous



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**With Renewable Seats, Interchangeable Concentric Valve, Compound Packing to Spindle, Special Metal, and High-Class Workmanship.**

The "SHAW" Patent Parallel Slide Valve is the Acme of Simplicity and Durability.

**Try Them !** Sent on Approval.

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**JOSEPH SHAW,** B Dept., Albert Works, **HUDDERSFIELD.**

**JOHN GIBBS & SON**

***Ventilating Engineers,***

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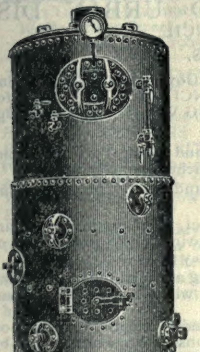
**LIVERPOOL.**

*Say Advertising does not pay.*

SEE OUR ILLUSTRATED ADVERTISEMENT NEXT. WEEK.



**Steam Boilers**

(OF ALL TYPES AND POWERS).

Manufactured by

**The GRANTHAM CRANK and IRON CO., Ltd., GRANTHAM.**

**Refuse Destructors.**

***Write for particulars to :—***

**HEENAN & FROUDE, LIMITED,**

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Works: MANCHESTER and WORCESTER.

**MACHINE TOOLS,**

**Special & General**

For Engineers, Shipbuilders, Boiler Makers, Girder Makers, and Bridge Builders.

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IS EXTENSIVELY UNDERTAKEN BY

**MESSRS. ELLIOTT & FRY**

in any part of the United Kingdom, for which work special terms will be sent on application, distance being no object.

ONLY ADDRESS :—
**55, Baker Street, LONDON, W.**

Telegrams: PHOTICS, LONDON. Telephone: 293 PADDINGTON.

**STEEL CONSTRUCTION**

IN ALL BRANCHES.

Buildings Designed and Erected in all Parts of the World.

ROOF FRAMES, TRUSSES AND GIRDERS,
BLAST FURNACES AND STEEL WORKS, CUPOLAS, LADLES, CONVERTERS,
BOILERS, TANKS, AND HEAVY PLATE WORK.
GAS HOLDERS, PURIFIERS, ETC.,
OPEN HEARTH FURNACE CASINGS.
CHIMNEYS, RIVETED PIPE, CORRUGATED IRON.

**RITER-CONLEY MFG., CO., PITTSBURG, P.A., U.S.A.**

New York Office : 39-41, Cortlandt Street.

# PAGE'S WEEKLY Contracts

## CONTRACTS.

### NEW SOUTH WALES.—TENDERS FOR IRON AND STEEL, to be Manufactured in the States.

TENDERS will be received at the office of the Secretary for Public Works, Sydney, Australia, up to Two o'clock p.m. on Friday, September 1st, 1905, for the MANUFACTURE, SUPPLY, and DELIVERY, in the State of New South Wales, of all IRON and STEEL REQUIRED by the GOVERNMENT.

Full particulars may be obtained from the Agent-General's Office, 9, Victoria Street, London, S.W.

JERSEY,
Acting Agent-General for New South Wales.

London,
March 24th, 1905.

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### COUNTY BOROUGH OF CROYDON.
STROUD GREEN WELL.

Notice is hereby given that the Council are prepared to receive TENDERS for a DEEP WELL PUMPING ENGINE and BOILERS for the Stroud Green Well, Woodside, Croydon.

Particulars and conditions may be seen, and a copy obtained on payment of a deposit of One Guinea, at the office of GEO. F. CARTER, A.M.Inst.C E., Borough Engineer, Town Hall, Croydon. The deposit will be returned upon receipt of a *bonâ fide* Tender.

Tenders to be sent to me by Eleven o'clock in the forenoon on Wednesday, the 26th April, 1905, endorsed "Pumping Plant, Stroud Green Well."

Tenders will only be received subject to the terms of the draft contract which has been deposited at the office of the Borough Engineer as aforesaid, and may be inspected during office hours.

The Council will not be bound to accept the lowest or any Tender.

F. C. LLOYD,
Town Clerk.

Town Hall, Croydon,
March 31st, 1905.

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### COUNTY BOROUGH OF STOCKPORT
TO ELECTRICIANS AND ENGINEERS.

The Gas and Electricity Committee are prepared to receive TENDERS for the SUPPLY of ONE 500 KW. STEAM GENERATOR.

Specification and particulars may be had on application to Mr. A. J. H. CARTER, Electricity Works, Millgate, Stockport, on payment of One Guinea, which will be returned on receipt of a *bona fide* Tender.

Persons tendering must submit drawings and full particulars to Mr. A. J. H. CARTER, Electricity Works, Millgate, Stockport, on or before April 17th, and Tenders, endorsed, "Dynamo," and addressed to the Chairman, Gas and Electricity Committee, must be handed in at the Town Clerk's office, Stockport, not later than Wednesday, the 26th April next ensuing.

No Tender will be accepted without satisfactory proof that the firm tendering pays the trade union rate of wages and observes the trade union number of hours as are usually paid and observed in the district where the goods are made or produced.

The Committee do not bind themselves to accept the lowest or any Tender.

By order,
ROBERT HYDE,
Town Clerk.

Stockport, March 31st, 1905.

---

### BOROUGH OF BATLEY.—BRADFORD ROAD TRAMWAYS RECONSTRUCTION.

The Batley Corporation invite TENDERS for the following Works in connection with the Extension of the Tramways in Bradford Road:—

Contract No. 14.—PERMANENT WAY CONSTRUCTION and PAVING.

Contract No. 15.—OVERHEAD EQUIPMENT, STEEL POLES, etc.

Contract No. 16.—FEEDER CABLES, CONDUITS, and ACCESSORIES.

Copies of the General Conditions, Specifications, Quantities, Form of Tender and Drawings may be obtained from Messrs. LACEY, SILLAR, AND LEIGH, 2, Queen Anne's Gate, Westminster, on and after the 29th inst., on payment of a deposit of £2 2s. in respect of each Contract, which will be returned on receipt of a *bonâ fide* Tender. Further copies of the Specification or Quantities can be obtained on payment of a further fee of Half-a-Guinea per copy, which will not be returned.

Tenders on the prescribed form, and endorsed "Tramways, Contract No. —," to be delivered at my office not later than April 17th proximo.

The Corporation do not bind themselves to accept the lowest or any Tender.

By order,
JOS. HANSON CRAIK,
Town Clerk.

Town Clerk's Office, Batley,
March 21st, 1905.

---

TENDERS will be received by the Montreal Water and Power Company up to May 15th next on a Fifteen Million Gallon High-duty STEAM PUMPING PLANT, BOILERS, etc., 175 lb. water pressure. Specifications can be had on application to the Office of the above Company, 62 Alliance Building, 107, St. James Street, Montreal, Canada

---

### MUNICIPALITY OF JOHANNESBURG.
SPECIFICATION No. 15.—SWITCHBOARDS.

The Council is prepared to receive TENDERS for the Supply and Erection of SWITCHBOARDS and ACCESSORIES for their New Direct and Alternating-current Power Station.

General Conditions, Specification, and Forms of Tender may be seen on and after Friday, March 31st, at the offices of the Council's Consulting Engineers, Messrs. MORDEY AND DAWBARN, 82, Victoria Street, Westminster, S.W., and may be obtained from them on payment of Five Guineas, which will be returned on receipt of a *bonâ fide* Tender. Further copies of the General Conditions, Specification, and Forms of Tender may be obtained on payment of 10s., which will not be returned.

Tenders are to be addressed to Messrs. MORDEY AND DAWBARN, 82, Victoria Street, Westminster, S.W., and must reach them not later than noon on Thursday, April 27th, 1905.

The Council does not bind itself to accept the lowest or any Tender, and is not responsible for the cost of tendering.

R. FEETHAM,
Town Clerk.

Johannesburg,
March 27th, 1905.

---

### MUNICIPAL COUNCIL OF GEORGE TOWN, PENANG.
ELECTRIC LIGHTING.

The Commissioners invite TENDERS for the Supply and Delivery f.o.b., of a:—

300KW. STEAM DYNAMO, MOTOR GENERATOR, BALANCER, SWITCHBOARDS, &c.

Copies of the Specification, with Form of Tender and General Conditions, can be obtained at the Offices of Messrs. PREECE AND CARDEW, 8, Queen Anne's Gate, Westminster, S.W., upon payment of a fee of One Guinea, which will be returned upon receipt of a *bonâ fide* Tender.

Duplicate Copies of the Specification can be obtained on payment of 5s., which will not be returnable.

Sealed Tenders, endorsed "Tender for Steam Dynamo, &c.," must be delivered to Mr. R. M. CHRISTIE, 4, East India Avenue, E.C., on or before 12 o'clock noon on Tuesday, April 18th, 1905.

The Commissioners do not bind themselves to accept the lowest or any Tender.

---

### BISHOP'S STORTFORD URBAN DISTRICT COUNCIL.
CONTRACTS.

Subject to the sanction of the Local Government Board being obtained to the necessary loans, the COUNCIL invite TENDERS for the CARRYING OUT of the FOLLOWING WORKS at their Sewage Pumping Station—viz.:—

CONTRACT No. 1.—For Supplying and Fixing Two Lancashire Boilers, 18 feet long by 6 feet 6 inches diameter.

CONTRACT No. 2.—For Supplying and Fixing Steam Pumping Engine and Pumps.

In connection with this Contract, persons tendering are required to submit detailed Drawings and Specifications of the type of Engine and Pumps they propose to supply.

CONTRACT No. 2A.—For Supplying and Fixing Gas Pumping Engine and Pumps, together with Suction Gas Plant complete.

Printed Specifications and Forms of Tender will be forwarded on application to the undersigned. Applications to be accompanied by a deposit of £2 2s. in each case, which will be returned on receipt of a *bonâ fide* Tender.

The person or firm whose Tender is accepted will be required to enter into a written contract and to provide two sureties.

Sealed Tenders, endorsed "Contract No. —" to be sent to me by 4 o'clock p.m. on Monday, the 8th day of May, 1905.

The Council do not bind themselves to accept any Tender

By order,
THOS. SWATHERIDGE,
Clerk of the Council.

Council Offices, 7, North Street, Bishop's Stortford,
March 17th, 1905.

---

### CITY OF ABERDEEN.—ELECTRICITY DEPARTMENT.

Tenders are invited for the Supply of ONE SURFACE CONDENSER, with Air Pump, Oil Separator, etc.

Specification, with General Conditions of Contract and Form of Tender may be obtained from the undersigned on and after 29th inst. on payment of £2, which sum will be returned upon receipt of a *bona fide* Tender.

Offers, endorsed "Tenders for Condenser," and addressed to the Engineer, must be delivered at or before noon on Wednesday, April 19th

Corporation Electricity Works,
Millburn Street, Aberdeen.

J. ALEX. BELL,
City Electrical Engineer.

# PAGE'S WEEKLY Contracts

THE DUBLIN PORT AND DOCKS Board is prepared to receive TENDERS for an ELECTRIC GENERATING STATION.

The specification and drawings, together with a special form of Tender, can be obtained at the office of the Engineer of the Board, JOHN P. GRIFFITH, Esq., M.Inst.C.E., East Wall, Dublin, on payment of Five Pounds, which will be refunded to firms sending in *bona fide* Tenders.

Tenders, with contractor's supplemental specification and drawings, marked on the outside of the cover "Tender for Electric Generating Station," must be delivered by post, sealed prepaid, and addressed to the Secretary, Port and Docks Office, Westmoreland Street, Dublin, on or before Monday, the 15th day of May, 1905.

The Board does not bind itself to accept the lowest or any tender.

By order,
N. PROUD,
Secretary.

Dublin Port and Docks Office,
April 3rd, 1905.

---

CLYDE NAVIGATION.—TO BOILER-MAKERS.

BOILERS AND SUPERHEATING APPARATUS.

The Trustees of the Clyde Navigation invite TENDERS for BOILERS and SUPERHEATING APPARATUS for Electric Power Generating Plant at Clydebank Dock.

Copies of the specification and form of Tender are to be had at this Office, from Mr. GEO. H. BAXTER, the Mechanical Engineer, on payment of £2 2s., which will be refunded on receipt of a *bona fide* Tender.

Sealed Tenders, marked "Tender for Boilers and Superheating Apparatus," to be lodged with the undersigned not later than noon on Monday, April 17th, 1905.

The Trustees may not accept the lowest or any Tender.

16, Robertson Street, Glasgow,
March 24th, 1905.

T. R. MACKENZIE,
General Manager and Secretary.

---

CLYDE NAVIGATION.—TO SHIP-BUILDERS.

DREDGER.

The Trustees of the Clyde Navigation invite TENDERS for a BOW-WELL CENTRE-LADDER SELF-PROPELLING DREDGER.

Drawings may be seen, and copies of the specification and form of Tender obtained, on application at this office to Mr. GEO. H. BAXTER, the Mechanical Engineer, on payment of £5 5s., which will be refunded on receipt of a *bonâ fide* Tender.

Sealed Tenders, marked "Tender for Dredger," to be lodged with the undersigned not later than noon on Monday, April 17th, 1905.

The Trustees may not accept the lowest or any Tender.

16, Robertson Street, Glasgow,
March 22nd, 1905.

T. R. MACKENZIE,
General Manager and Secretary.

---

BRISTOL DOCKS.—THREE ELECTRIC LIFTS.

The Docks Committee of the City and County of Bristol are prepared to receive TENDERS for the CONSTRUCTION, DELIVERY, ERECTING in place, FITTING, TESTING, and MAINTENANCE for twelve months after completion, of TWO ELECTRIC GOODS LIFTS and ONE ELECTRIC PASSENGER LIFT, to be erected in the Tobacco Warehouse now in course of construction near Cumberland Basin, Bristol.

On and after Tuesday, April 11th, 1905, copies of the specification, form of Tender, form of Contract, and Copies of Contract Drawing can be obtained from the undersigned on production of a receipt from the Secretary of the Docks Committee showing that £3 has been paid as deposit. The deposit of £3 will be returned to *bona fide* tenderers hereafter.

Tenders must be enclosed in a sealed envelope, endorsed "Tender for Electric Lifts," and addressed to the Secretary of the Docks Committee, 19, Queen Square, Bristol, and must be delivered to him, accompanied by the prescribed documents, before 10 a.m. on Monday, May 1st, 1905.

The Docks Committee of the Council of the City and County of Bristol do not bind themselves to accept the lowest or any Tender.

W. W. SQUIRE,
Engineer.

Engineer's Office, Cumberland Basin, Bristol.
April 5th, 1905.

---

REFUSE DESTRUCTOR AND FLAG-MAKING PLANT.

MUNICIPAL COUNCIL OF THE CITY OF SYDNEY, NEW SOUTH WALES.

The Municipal Council of the City of Sydney, New South Wales, invite TENDERS for the SUPPLY and ERECTION of SIX-CELL REFUSE DESTRUCTOR and for a FLAG-MAKING PLANT at Moore Park, within the City of Sydney, New South Wales.

Conditions of Contract, Specifications, and Tender Forms may be obtained on application to the Acting Agent-General for the State of New South Wales, Victoria Street, Westminster, S.W.

Tenders will be received up to Tuesday, May 30th, 1905, addressed to the Town Clerk, Town Hall, Sydney, New South Wales, endorsed "Tenders for Destructor and Flag Plant."

THOMAS H. NESBITT,
Town Clerk.

Town Clerk's Room, Town Hall, Sydney,
February 9th, 1905.

---

CITY OF BRADFORD.—The Corporation invite TENDERS for the SUPPLY and ERECTION of WROUGHT-IRON RAILING and GATES at the Girlington Recreation Ground, Four Lane Ends, Bradford.

Drawings, Specifications, and Conditions may be inspected and Form of Tender obtained at the Office of Mr. J. H. COX, M.Inst.C.E., City Surveyor, Town Hall, Bradford.

Tenders, endorsed "Tender for Wrought-Iron Railing, Girlington Recreation Ground," must be delivered to the Town Clerk, Bradford, on or before Thursday, the 20th inst.

The Contract will be let subject to the fair contracts clauses of the Corporation, which may be seen at the Town Clerk's Office, and which the successful Contractor will be required to sign.

The Corporation do not bind themselves to accept the lowest or any Tender.

FREDERICK STEVENS,
Town Clerk.

Town Hall, Bradford,
April 3rd, 1905.

---

COLCHESTER CORPORATION WATER-WORKS.

TO PUMPING ENGINE and BOILER MAKERS, CONTRACTORS, AND OTHERS.

Notice is Hereby Given that the Corporation of Colchester are prepared to receive TENDERS for the SUPPLY, DELIVERY, ERECTION, FIXING, LAYING, JOINTING, SETTING TO WORK, and MAINTAINING for a given period, a TRIPLE-EXPANSION HORIZONTAL PUMPING ENGINE of the Worthington type, a MULTITUBULAR STEEL BOILER, TRAVELLER, CAST IRON PUMPING AND SUCTION MAINS, with CONNECTIONS to Existing Mains.

Plans and specification may be seen between 10 a.m. and 5 p.m. on and after 3rd inst., at the office of the undersigned, and a copy of the specification, with form of Tender attached, may be obtained on deposit of One Guinea, which will be returned to each depositor on his making a *bonâ fide* Tender, and returning the documents entrusted to him after a contract has been entered into.

Persons or firms tendering must tender for the whole scheme, and it is indispensable that they shall have had extensive experience in similar work, and be prepared to furnish good and approved security for the due fulfilment of the contract.

Tenders must be delivered at the Town Clerk's Office, Town Hall, by not later than 28th instant, in sealed covers, addressed to the Corporation of Colchester, and endorsed "Tender for Engine, Boiler, etc."

The Corporation do not bind themselves to accept the lowest or any Tender, nor will they pay any expenses in connection with any Tender.

By order,
C. E. BLAND,
Waterworks Superintendent.

Town Hall, Colchester,
April 3rd, 1905.

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# APPOINTMENTS OPEN.

INDIAN PUBLIC WORKS DEPARTMENT.

THE SECRETARY OF STATE FOR India in Council will, in the Summer of 1905, make not less than TWENTY-FIVE APPOINTMENTS of ASSISTANT ENGINEER in the permanent establishment of the Indian Public Works Department in addition to the appointments to be made from Coopers Hill College.

The age of candidates must not be less than 21, or more than 24, years on the 1st July, 1905.

A printed form of application, together with information regarding the conditions of the appointments and certain requirements laid down as to education and experience in engineering may be obtained from the Secretary Public Department, India Office, Whitehall, London, S.W.

The form of application is to be returned not later than Monday, 1st May next.

A. GODLEY,
Under Secretary of State.

India Office,
March 23rd, 1905.

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BOROUGH OF SWINDON.
EDUCATION COMMITTEE.

SWINDON AND NORTH WILTS SECONDARY SCHOOL AND TECHNICAL INSTITUTION.

President: Mr. G. H. BURKHARDT, M.Sc.

The Committee require, early in September next, an

ASSISTANT LECTURER IN ENGINEERING, who will be required to take Classes in Electrical Engineering. Salary, £150 a year.

Form of Application, which must be returned by April 29th, may be had from

W. SEATON,
Secretary

Education Office, Town Hall, Swindon.
April 3rd, 1905.

# BUYERS' DIRECTORY.

NOTE.—*The display advertisements of the firms mentioned under each heading can be found readily by reference to the Alphabetical Index to Advertisers on pages* 35, 37, 38, *and* 40.

*In order to assure fair treatment to advertisers, each firm is indexed under its leading speciality* ONLY.

*Advertisers who prefer, however, to be entered under two or more different sections can do so by an annual payment of* 5s. *for each additional section.*

### Artesian Well Machinery.
John Z. Thom, Patricroft, Manchester.

### Belting.
Binney & Son, Catherine Street. City Road, London, E.C.
Cort, Arthur, & Co., Camberwell, London, S.E.
Fleming, Birkby & Goodall, Ltd., West Grove, Halifax.
Gilmour, W. & O., St. John's Hill, Edinburgh.

### Boilers.
Clayton, Son & Co., Ltd., Leeds City Boiler Works, Leeds.
Grantham Crank & Iron Co., Ltd., Grantham.
Hartley & Sugden, Ltd., Halifax.

### Boilers (Water-tube).
Babcock & Wilcox, Ltd., Oriel House, Farringdon Street, London, E.C.
Cochran & Co. (Annan), Ltd., Annan, Scotland.
Stirling Boiler Co., Ltd., Motherwell, N.B.

### Bolts, Nuts, Rivets, etc.
Herbert W. Periam, Ltd., Floodgate Street Works, Birmingham.
T. D. Robinson & Co., Ltd., Derby.

### Books.
Crosby Lockwood & Son, Stationers' Hall Court, London, E.C.
Griffin, Charles, & Co., Exeter Street, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.
Spon, E. & F. N., 125, Strand, W.C.
World's Work and Play.

### Cables.
St. Helen's Cable Co., Ltd., Warrington, Lancashire.

### Case-Hardening Compounds.
Hy. Miller & Co., Millgarth Works, Leeds.

### Catalogues, Printing, &c.
Atlantic Press, Ltd., Weymouth Street, Manchester.
Southwood, Smith & Co., Ltd., Plough Court, Fetter Lane, London, E.C.
Spottiswoode Advertising Agency, 8, New Street Square, E.C.
Stafford, Arthur, & Co., Denton, Manchester.

### Chucks.
Fairbanks Co., 78-80, City Road, London, E.C.

### Cisterns, Tanks, &c.
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

### Clutches (Friction).
David Bridge & Co., Castleton Ironworks, Rochdale, Lancashire.

### Colliery Plants.
Graham, Morton & Co., Ltd., Leeds.

### Condensing Plant.
Benn, Sykes, Haslingden, near Manchester.
Concentric Condenser, Ltd., 23, Northumberland Avenue, London, W.C.
Mirrlees-Watson & Co., Ltd., Glasgow.

### Condensed Water Purifiers.
Lassen & Hjort, 52, Queen Victoria Street, London, E.C.

### Consulting Engineers.
Gibbs, John, & Son, 80, Juke Street, Liverpool.
G. H. Hughes, A.M.I.M.E., 97, Queen Victoria Street, London, E.C.
Melville & Macalpine, 615, Walnut Street, Philadelphia, Pa., U.S.A.

### Continental Railway Arrangements.
South Eastern & Chatham Railway Co.

### Conveying and Elevating Machinery.
Adolf Bleichert & Co., Leipzig-Gohlis, Germany.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Graham, Morton & Co., Ltd., Leeds.
Temperley Transporter Co., 72, Bishopsgate Street Within, London, E.C.

### Coverings (Boiler).
Magnesia Coverings, Ltd., Washington Station, co. Durham.

### Cranes, Travellers, Winches, etc.
Joseph Booth & Bros. Ltd, Rodley, Leeds.
Thomas Broadbent & Sons, Ltd., Huddersfield
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W

### Cranks.
Clarke's Crank & Forge Co., Ltd., Lincoln, England.

### Cutters (Milling).
E. G. Wrigley & Co., Ltd., Foundry Lane Works, Soho, Birmingham.

### Destructors.
Heenan & Froude, 4, Chapel Walks, Manchester.
Horsfall Destructor Co., Ltd., Armley, Leeds.

### Dredges and Excavators.
Delange & Cie, Mce., Hoboken, near Antwerp.
Rose, Downs & Thompson, Ltd., Old Foundry, Hull.

### Drilling Machines.
Swift, George, Claremont Ironworks, Halifax.

### Economisers.
E. Green & Son Ltd., Manchester.

### Ejectors (Pneumatic).
Hughes & Lancaster, 47, Victoria Street, London, S.W.

### Electrical Apparatus.
Allgemeine Elektricitäts Gesellschaft, Berlin, Germany.
Broadbent, T. W., Victoria Electrical Works, Huddersfield.
Crypto Electrical Co., 3, Tyer's Gateway, Bermondsey Street, London, S.E.
Gent & Co., Ltd., Faraday Works, Leicester.
Greenwood & Batley, Ltd., Albion Works, Leeds.
India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., The Silvertown, London, E.
Mather & Platt, Ltd., Salford Iron Works, Manchester.
Matthews & Yates, Ltd., Swinton, Manchester.
Mix and Genest, Berlin, W., Germany.
Nalder Bros. & Thompson, 34, Queen Street, London, E.C.
Newton Brothers, Full Street, Derby.
Phœnix Dynamo Manufacturing Co., Bradford, Yorks.
Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.
Turner, Atherton & Co., Ltd., Denton, Manchester.
B. Weaver & Co., 22, Rosoman Street, Clerkenwell, London, E.C.

### Engineers' Supplies.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

### Engines (Gas).
Campbell Gas Engine Co., Ltd., Halifax.
Soest, L., & Co., Ltd., 114-116, Victoria Street, London, S.W.

### Engines (Electric Lighting).
McLaren, J. and H., Midland Engine Works, Leeds.

### Engines (Locomotive).
Baldwin Locomotive Works, Philadelphia, Pa., U.S.A.
Hunslet Engine Co., Ltd., Leeds, England.
Hudswell, Clarke & Co., Ltd., Leeds, England.
McLaren, J. & H., Midland Engine Works, Leeds.

### Engines (Portable).
Garrett, R., & Sons, Leiston, R.S.O., Suffolk.

### Engines (Stationary).
Allis-Chalmers Co., 533, Salisbury House, Finsbury Circus, London, E.C.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Garrett, R., & Sons, Leiston, R.S.O., Suffolk.
Mirrlees Watson Co., Ltd., Glasgow.

### Engines (Traction).
Jno. Fowler & Co. (Leeds), Ltd., Steam Plough Works, Leeds.
Garrett & Sons, Ltd., Richard, Leiston, R.S.O., Suffolk.

### Engravers.
Jno. Swain & Son, Ltd., 58, Farringdon Street, London, E.C.

### Exhaust Steam Oil Separators.
Lassen & Hjort, 52, Queen Victoria Street, London, E.C.

### Fans, Blowers.
Capel Fan Co., 13, Moseley Street, Newcastle-on-Tyne.
Davidson & Co., Ltd., "Sirocco" Engineering Works, Belfast, Ireland.
Gibbs, John & Son, 80, Juke Street, Liverpool.
James Keith & Blackman Co., Ltd., 27, Farringdon Avenue, London, E.C.
Matthews & Yates, Ltd., Swinton, Manchester.

### Fire Bricks.
J. H. Sankey & Son, Ltd., Essex Wharf, Canning Town, London, E.

## PAGE'S WEEKLY Weighing Machines

BY ROYAL WARRANT TO H.M. THE KING

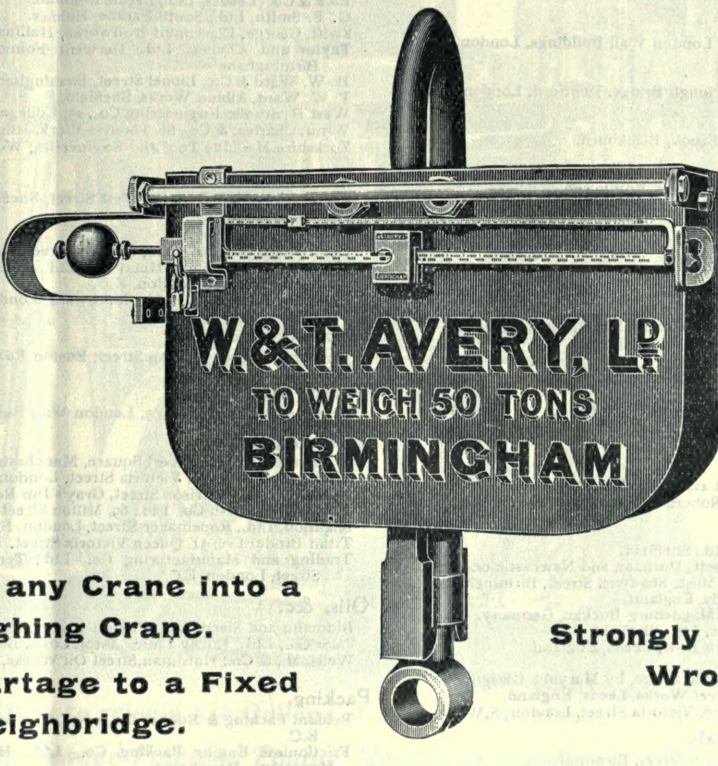
# W. & T. AVERY LTD.

ESTD 1730

SOHO FOUNDRY

BIRMINGHAM

**THE LARGEST MAKERS OF WEIGHBRIDGES IN THE WORLD**



**Converts any Crane into a Weighing Crane.**

**Saves Cartage to a Fixed Weighbridge.**

**Strongly Constructed of Wrought Iron.**

# AVERY'S Crane Weighing Machines.

**CAPACITIES, 10 Cwt. 100 Tons.**

Write for Illustrated Price List of Crane Weighing Machines.

## Buyers' Directory—(*Continued*).

### Firewood Machinery.
M. Glover & Co., Patentees and Saw Mill Engineers, Leeds.

### Fountain Pens.
Mabie, Todd & Bard, 93, Cheapside, London, E.C.

### Forging (Drop) Plants.
Brett's Patent Lifter Co., Ltd., Coventry.

### Forgings (Drop).
J. H. Williams & Co., Brooklyn, New York, U.S.A.

### Furnaces.
Deighton's Patent Flue & Tube Company, Vulcan Works, Pepper Road, Leeds.
Leeds Forge Co., Ltd., Leeds.
W. F. Mason, Ltd., Engineers, Manchester.

### Gas Producers.
Graham, Morton & Co., Ltd., Leeds.
W. F. Mason, Ltd., Engineers, Manchester.
Power-Gas Corporation, Ltd., 39, Victoria Street, London, S.W.

### Gauge Glasses.
J. B. Treasure & Co., Vauxhall Road, Liverpool.

### Gearing.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.
Hamilton & Co., J. B., 145, Cannon Street, E.C.
Reid Gear Co., Linwood, near Glasgow.
Wild, M. B., & Co., Corporation Street, Birmingham.

### Gold Dredging Plant.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

### Greases.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.

### Hack Saws.
Baynes, Charles, Knuzden Brook, Blackburn.

### Hammers (Steam).
Davis & Primrose, Leith Ironworks, Edinburgh.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

### Hoisting Machinery.
*See* Conveying Machinery.

### Horizontal Boring Machines.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

### Hydraulic Leather.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

### Icemaking and Refrigerating Machinery.
H. J. West & Co., 114-118, Southwark Bridge Road, London, S.E.

### Indicators.
Dobbie McInnes, Ltd., 41 & 42, Clyde Place, Glasgow.
Hannan & Buchanan, 75, Robertson Street, Glasgow.

### Iron and Steel.
Askham Bros. & Wilson, Ltd., Sheffield.
Consett Iron Co., Ltd., Consett, Durham, and Newcastle-on-Tyne.
Fairley & Sons, James, Old Mint, Shadwell Street, Birmingham.
Farnley Iron Co., Ltd., Leeds. England.
Fried. Krupp, Grusonwerk, Magdeburg-Buckau, Germany.
Hadfield's Steel Foundry Co., Ltd., Sheffield.
J. Frederick Melling, 14, Park Row, Leeds, England.
Parker Foundry Co,, Derby.
Purden, John & Sons, Lambhill Forge, by Maryhill. Glasgow.
Walter Scott, Ltd., Leeds Steel Works, Leeds, England.
Gilbert Thompson & Co., 116, Victoria Street, London, S.W.

### Ironwork (Constructional).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

### Ironwork (Galvanised).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

### Lagging Sheets.
Zeitz & Co., 21, Lime Street, London, E.C.

### Lathes.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Eclipse Tool Manufacturing Co., Linwood, near Glasgow.
Leckenby, Benton, & Co., Perseverance Ironworks, Halifax.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Northern Engineering Co. (1900) Ltd., King Cross, near Halifax.
Swift, George, Claremont Ironworks, Halifax.

### Lathe Carriers.
Williams, J. H , & Co., Brooklyn, New York, U.S.A.

### Laundry Machinery.
W. Summerscales & Sons, Ltd., Engineers, Phœnix Foundry, Keighley, England.

### Lifts.
Waygood & Co., Ltd., Falmouth Road, London, S.E.

### Lubricants.
Blumann & Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Reliance Lubricating Oil Co., The, 19 & 20, Water Lane, Great Tower Street, London, E.C.
Matthew Wells & Co., Hardman Street Oil Works, Manchester.

### Machine Tools.
Asquith, William, Ltd., Highroad Well Works, Halifax.
George Addy & Co., Waverley Works, Sheffield.
Bateman's Machine Tool Co., Hunslet, Leeds.
Hy. Berry & Co., Ltd., Leeds.
Bertrams, Ltd., St. Katherine's Works, Sciennes, Edinburgh.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Breuer, Schumacher & Co., Ltd., Kalk, near Cologne-on-Rhine (Germany).
Cunliffe & Croom, Ltd., Broughton Ironworks, Manchester.
Dean, Smith & Grace, Ltd., Keighley.
Greenwood & Batley, Ltd., Leeds.
Jones & Lamson Machine Co., 97, Queen Victoria Street, London, E.C.
John Lang & Sons, Johnstone, near Glasgow.
Luke & Spencer, Ltd., Broadheath, Manchester.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Jos. C. Nicholson Tool Co., City Rd. Tool Wks., Newcastle-on-Tyne.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund, Ltd., Felling-on-Tyne.
Northern Engineering Co., 1900, Ltd., King Cross, near Halifax.
J. Parkinson & Son, Canal Ironworks, Shipley, Yorkshire.
C. Redman & Sons, Halifax.
Rice & Co. (Leeds), Ltd., Leeds, England.
G. F. Smith, Ltd., South Parade, Halifax.
Swift, George, Claremont Ironworks, Halifax.
Taylor and Challen, Ltd., Derwent Foundry, Constitution Hill, Birmingham.
H. W. Ward & Co., Lionel Street, Birmingham.
T. W. Ward, Albion Works, Sheffield.
West Hydraulic Engineering Co., 23, College Hill. London, E.C.
Winn, Charles, & Co., St. Thomas Works, Birmingham.
Yorkshire Machine Tool and Engineering Works, Liversedge, Yorks.

### Marks.
Pryor, Edward, & Son, 68, West Street, Sheffield.

### Metals.
Delta Metal Co., Ltd., 110, Cannon Street, London, E.C.
Magnolia Anti-Friction Metal Co., Ltd., of Great Britain, 49, Queen Victoria Street, London, E.C.
Phosphor Bronze Co., Ltd., Southwark, London, S.E.

### Metals (Perforated).
W. Barns & Son, Chalton Street, Euston Road, London, N.W.

### Mining Machinery.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

### Office Appliances.
Halden & Co., J., 8, Albert Square, Manchester.
Hall & Co., B. J., 39, Victoria Street, London, S.W.
Lyle Co., Ltd., Harrison Street, Gray's Inn Road, London, W.C.
Rockwell-Wabash Co., Ltd., 69, Milton Street, London, E.C.
Shannon, Ltd., Ropemaker Street, London, E.C.
Titan Binder Co., 31. Queen Victoria Street, London, E.C.
Trading and Manufacturing Co., Ltd., Temple Bar House, Fleet Street, London, E.C.

### Oils, &c.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Valor Co., Ltd., Rocky Lane, Aston Cross, Birmingham.
Wells, M., & Co., Hardman Street Oil Works, Manchester.

### Packing.
Beldam Packing & Rubber Co., 93-94, Gracechurch Street, London, E.C.
Frictionless Engine Packing Co., Ltd., Hendham Vale Works, Harpurhey, Manchester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.
Redfern & Co., S., Swan Lane, New Brown Street, Manchester.
Quaker City Rubber Co., Coronation House, Lloyd's Avenue, E.C.
United Kingdom Self-Adjusting Anti-Friction Metallic Packing Syndicate, 14, Cook Street, Liverpool.
United States Metallic Packing Co., Ltd., Bradford,
J. Bennett von der Heyde, 6, Brown Street, Manchester.

### Paint (Metallic).
Metallic Paint Co., Ltd., Cardiff.

### Paper.
Lepard & Smiths, Ltd., 29, King Street, Covent Garden, London, W.C.

### Patent Agents.
Page & Rowlingson, 28, New Bridge Street, London, E.C.

## PAGE'S WEEKLY Pumping Machinery

# Pumping Machinery

### FOR WATERWORKS AND MINES.

## Official

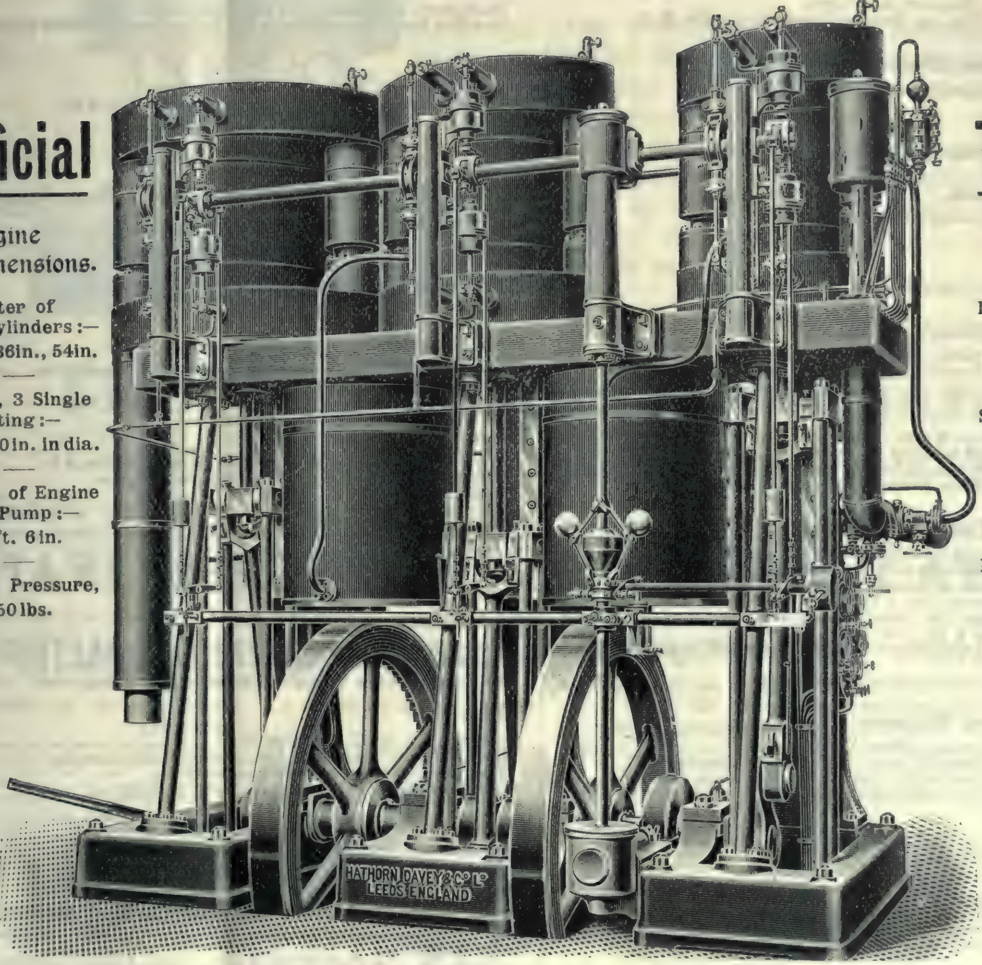
**Engine Dimensions.**

Diameter of Cylinders:—
20in., 36in., 54in.

Rams, 3 Single Acting:—
Each 30in. in dia.

Stroke of Engine and Pump:—
3 ft. 6 in.

Steam Pressure,
150 lbs.



## Trial.

**Engine Results.**

Pump Horse Power —
274·55.

Saturated Steam per Indicated Horse Power per hour:—
12·4 lbs.

Mechanical Efficiency —
92·8 per cent.

Contract Duty to raise 6,240 Gallons of sewage per minute 125 feet high.

*Triple Expansion Sewage Pumping Engine, Melbourne and Metropolitan Board of Works.*

---

# HATHORN, DAVEY & CO.,

LIMITED.

## LEEDS, England.

*Codes Used:*
A.B.C. 4th Edition.
Universal Mining Code.

*Telegrams:*
"HATHORN, LEEDS

## Buyers' Directory—(*Continued*).

**Photo Copying Frames.**

J. Halden & Co., 8, Albert Square, Manchester.
B. J. Hall & Co., 39, Victoria Street, London, S.W.

**Photographers.**

Booker & Sullivan, 67 and 69, Chancery Lane, W.C.
Elliott & Fry, 55, Baker Street, London, W.

**Photographic Apparatus.**

Marion & Co., Ltd., 22, 23, Soho Square, London, W.

**Pinch Bars.**

Samson & Co., Garforth, near Leeds.
Stone & Co., J. B., 135, Finsbury Pavement, London, E.C.

**Pipe Wrenches (Chain).**

Williams, J. H., & Co., Brooklyn, New York, U.S.A.

**Pistons.**

Lancaster & Tonge, Ltd., Pendleton, Manchester.

**Planished Sheets.**

Zeitz & Co., 21, Lime Street, London, E.C.

**Porcelain.**

Gustav Richter, Charlottenburg, near Berlin, Germany.

**Presses (Hydraulic).**

Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

**Publishers.**

Crosby Lockwood & Son, 7, Stationers' Hall Court, London, E.C.
Charles Griffin & Co., Ltd., Exeter Street, Strand, London, W.C.
Spon, E. and F. N., 125, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.

**Pumps and Pumping Machinery.**

Drum Engineering Co., 27, Charles Street, Bradford.
Enke, Carl, Schkeuditz-Leipzig, Germany.
Fairbanks, Morse & Co., 126, Southwark Street, London, S.E.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
J. P. Hall & Sons, Ltd., Peterborough.
Hathorn, Davey & Co., Ltd., Leeds, England.
Positive Rotary Pumps, Ltd., 23, Northumberland Avenue, London, W.C.
Tangyes, Ltd., Cornwall Works, Birmingham.

**Radial Drilling Machines.**

Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Northern Engineering Co. (1900), Ltd., King Cross, near Halifax.
Swift, George, Claremont Ironworks, Halifax.

**Rails.**

Wm. Firth, Ltd., Leeds.

**Railway Wagons.**

Nye, A. W., 110, Cannon Street, London, E.C.
W. R. Renshaw & Co., Ltd., Phœnix Works, Stoke-on-Trent.

**Riveted Work**

F. A. Keep, Juxon & Co., Forward Works, Barn Street, Birmingham.

**Roofs.**

D. Anderson & Son, Ltd., Lagan Felt Works Belfast.
Graham, Morton & Co., Ltd., Leeds.
Head, Wrightson & Co., Ltd., Thornaby-on-Tees.

**Ropeways (Aerial).**

Bullivant & Co., Ltd., 72, Mark Lane, London, E.C.

**Scientific Instruments.**

Cambridge Scientific Instrument Co., Ltd. Cambridge.

**Spanners.**

Williams, J. H. & Co., Brooklyn, New York, U.S.A.

**Stampings.**

Thomas Smith & Sons of Saltley, Ltd., Birmingham.
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

**Stamps (Rubber).**

Rubber Stamp Co., 1 & 2, Holborn Buildings, Broad Street Corner Birmingham.

**Stamps (Metal).**

Edward Pryor & Son, 68, West Street, Sheffield.

**Steam Traps.**

British Steam Specialties, Ltd., Fleet Street, Leicester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

**Steam Wagons.**

Thornycroft & Co., Ltd., J. I., Chiswick, London, W.
Yorkshire Patent Steam Wagon Co., Pepper Road, Hunslet, Leeds.

**Steel Tools.**

Saml. Buckley, St. Paul's Square, Birmingham.
Pratt & Whitney Co., 23-25, Victoria Street, London, S.W.

**Stokers.**

Ed. Bennis & Co., Ltd., Bolton, Lancs.
Meldrum Brothers, Ltd., Atlantic Works, Manchester.

**Stone Breakers.**

S. Pegg & Son, Alexander Street, Leicester.

**Superheaters.**

A. Bolton & Co., 40, Deansgate, Manchester.

**Time Recorders.**

Howard Bros., 10, St. George's Crescent, Liverpool, and 100C Queen Victoria Street, London, E.C.
Recorders, Ltd., 171, Queen Victoria Street, London, E.C.

**Tubes.**

Premier Boiler Tubes, Ltd., 28, Victoria Street, London, S.W.
Thomas Piggott & Co., Ltd., Spring Hill, Birmingham.
Tubes, Ltd., Birmingham.

**Turbines.**

G. Gilkes & Co., Ltd., Kendal.
Greenwood & Batley, Albion Works, Leeds.
S. Howes, 64, Mark Lane, London, E.C.

**Typewriters.**

Elliott-Fisher Co., 85, Gracechurch Street, London, E.C.
Empire Typewriter Co., 77, Queen Victoria Street, London, E.C.
Yost Typewriter Co., 50, Holborn Viaduct, London, E.C.

**Valves.**

Holmes & Co., W. C., Huddersfield.
Scotch and Irish Oxygen Co., Ltd., Rosehill Works, Glasgow.
Shaw, Joseph, Albert Works, Huddersfield.
Winn, Charles, & Co., St. Thomas Works, Birmingham.

**Ventilating Appliances.**

Matthews & Yates, Ltd., Swinton, Manchester.

**Wagons—Steam.**

Thornycroft & Co., J. I., Ltd., Chiswick, London, W.

**Water Softeners.**

Lassen & Hjort, 52, Queen Victoria Street London, E.C.

**Weighing Apparatus.**

W. T. Avery & Co., Soho Foundry, Birmingham, England.
Samuel Denison & Son, Hunslet Moor, near Leeds.
Graham, Morton & Co., Ltd., Leeds.

**Wells Light.**

A. C. Wells & Co., 100A, Midland Road, St. Pancras, London, N.W.

**Wind and Water Supply Machinery.**

Eric S. A. Smith, Bridlington.

**Wire Working Machinery.**

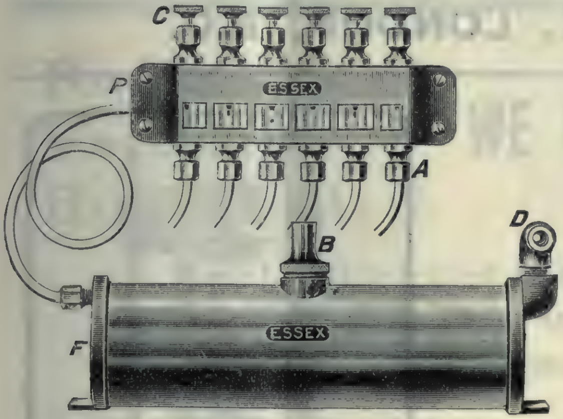
Ed. Brand, 35, Shakespeare Street, Manchester.

**"Woodite."**

"Woodite" Company, Mitcham, Surrey.

## PAGE'S WEEKLY Miscellaneous

# Automatic Multifeed Oilers



## FOR MOTOR CARS

This illustration shows the Multifeed Oiler, with detached Reservoir, which can be placed in most convenient space any distance desired from the the position of the Sight Feeds. Having once adjusted the Feeds to give the proper amount of lubrication no further attention is required except to see the Reservoir is supplied with oil. It starts and stops with the engine and is perfectly automatic.

**WRITE FOR CATALOGUE No. 229.**

## The Fairbanks Company,

78-80, City Road, LONDON, E.C.

**GLASGOW OFFICE: No. 56, Bothwell Street.**

---

# CHARLES GRIFFIN & CO.'S PUBLICATIONS.

*SECOND EDITION, Revised. In Large 8vo. Profusely Illustrated.* **24s. net.**

## CENTRAL ELECTRICAL STATIONS:

**Their Design, Organisation, and Management.**

**By CHAS. H. WORDINGHAM, A.K.C., M.I.C.E., M.I.M.E.**

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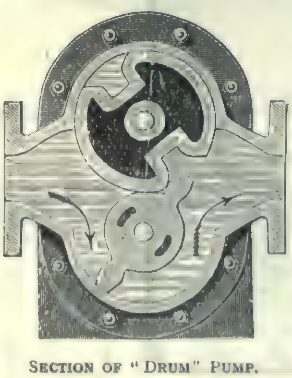

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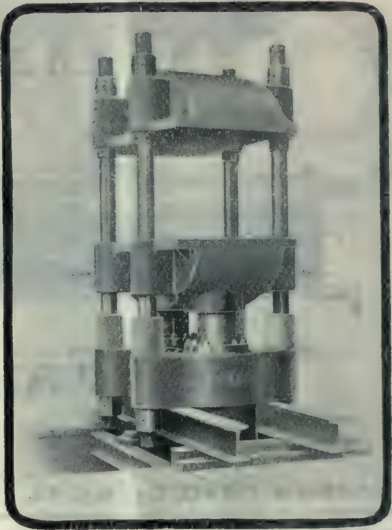

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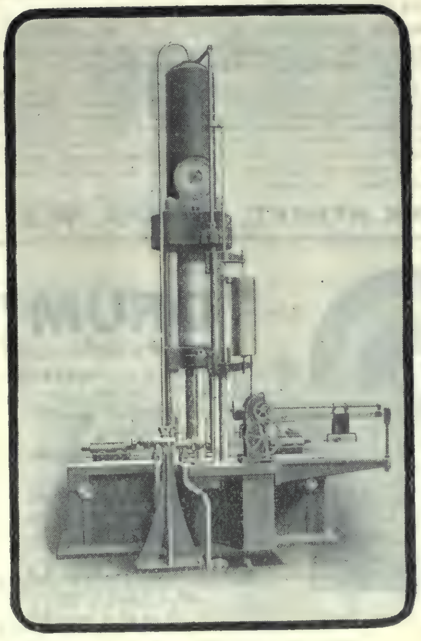

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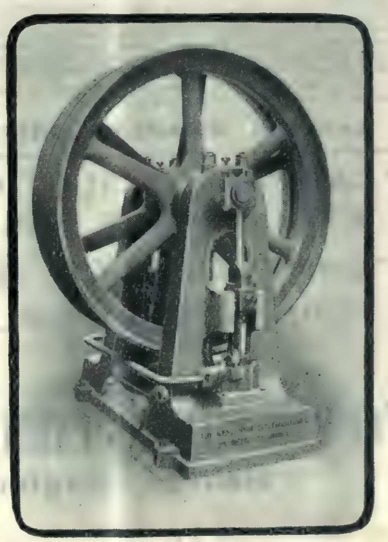

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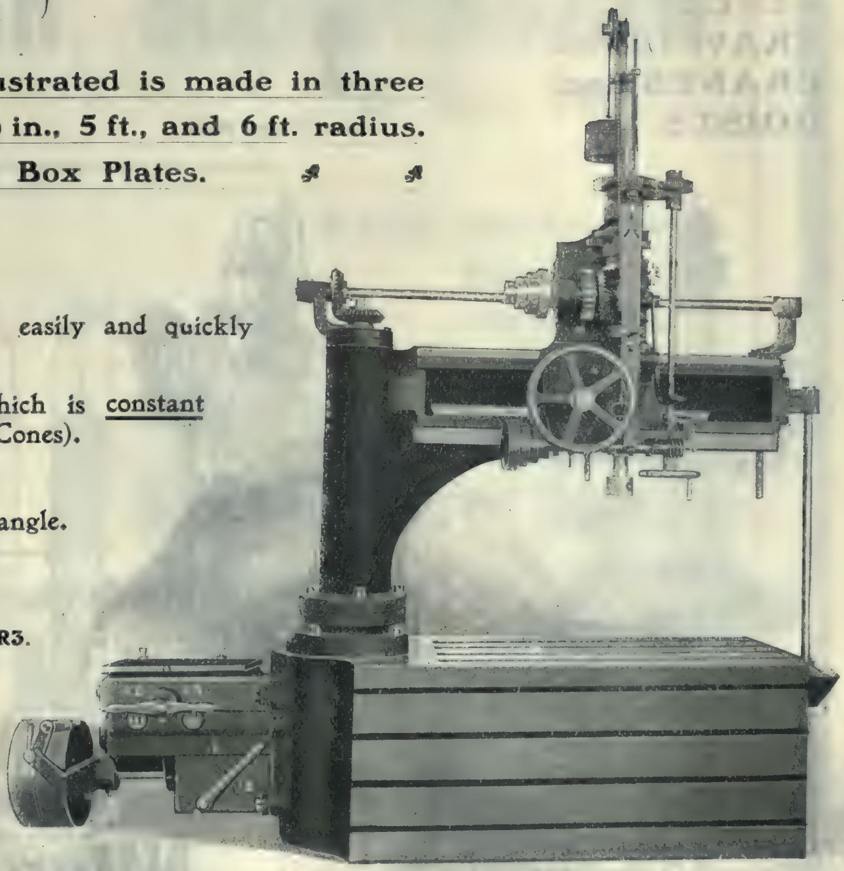

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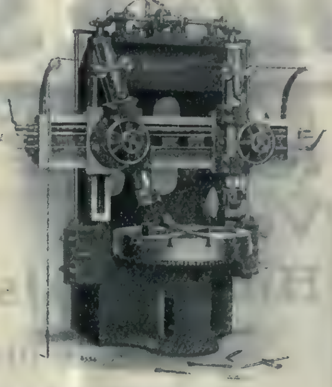

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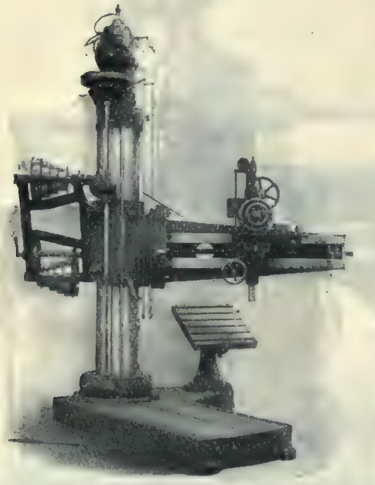

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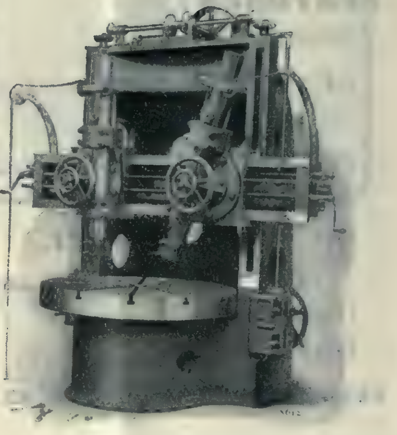
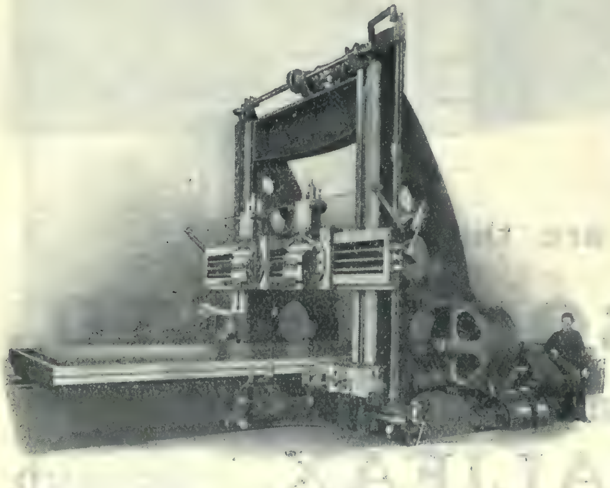


51 in, Boring Mill.



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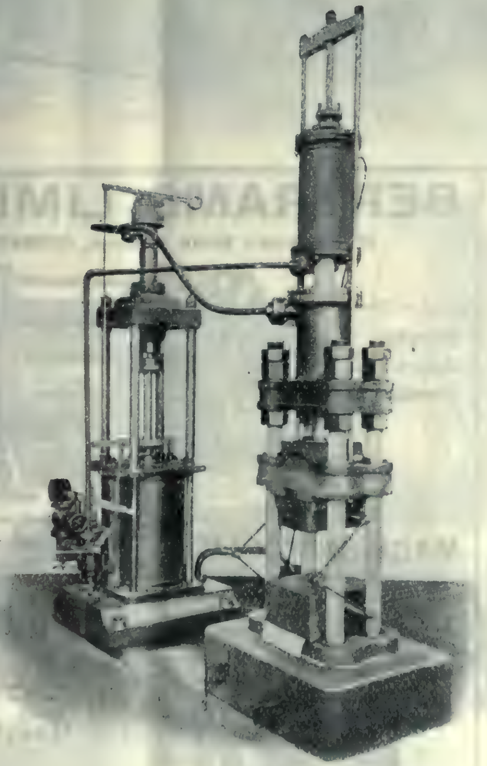

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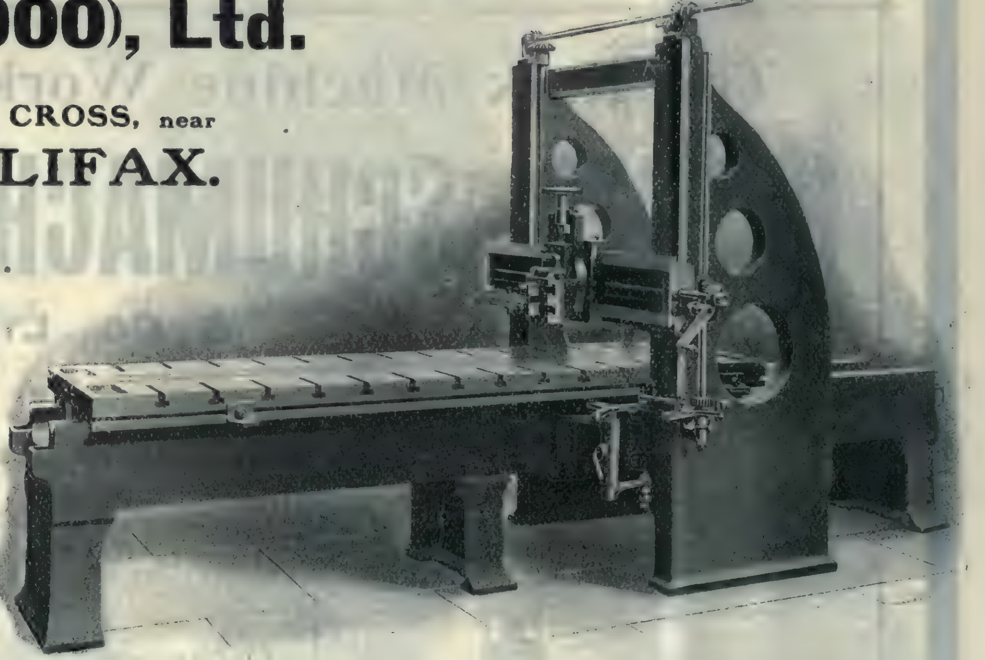

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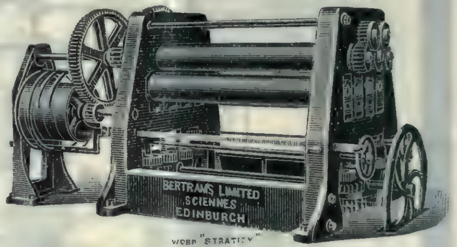

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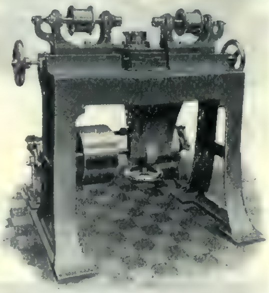

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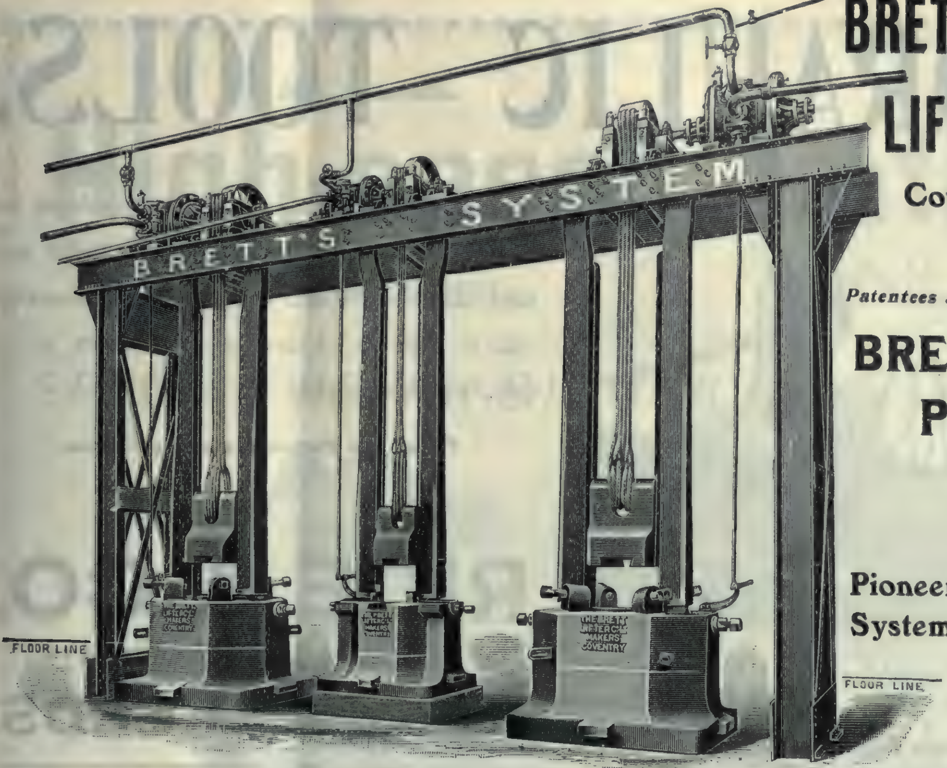
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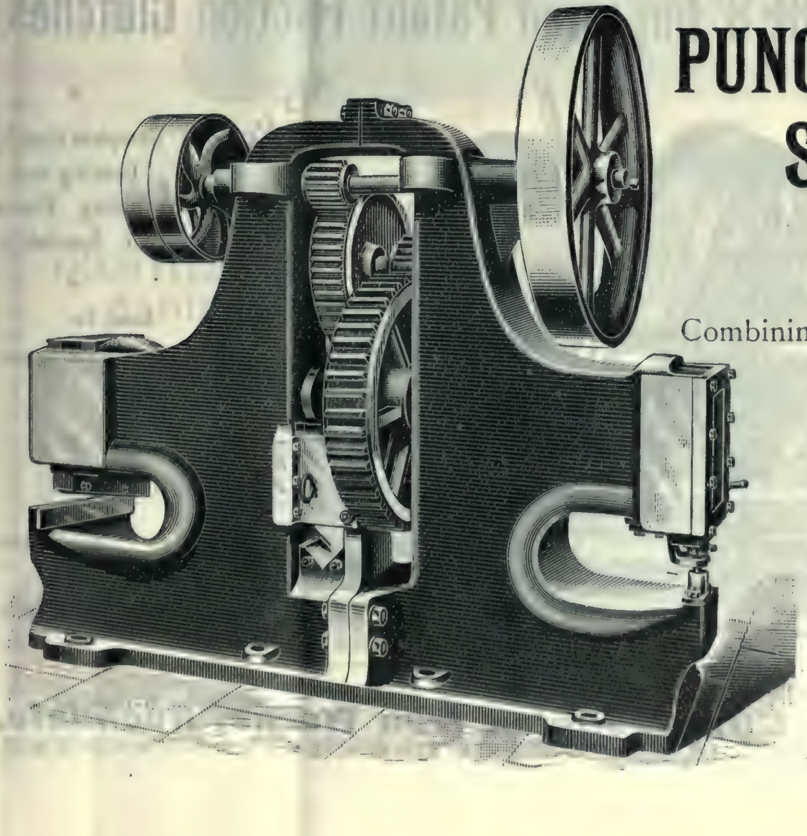

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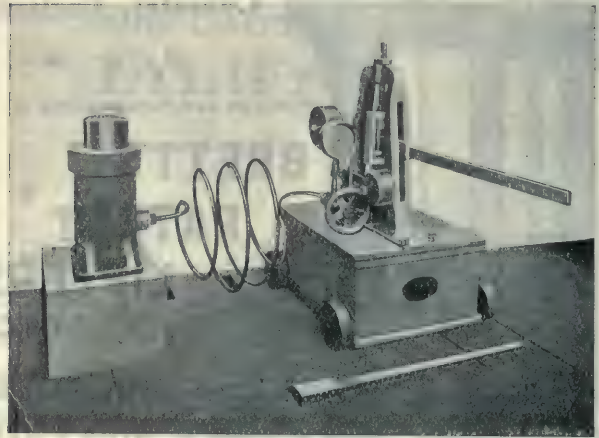

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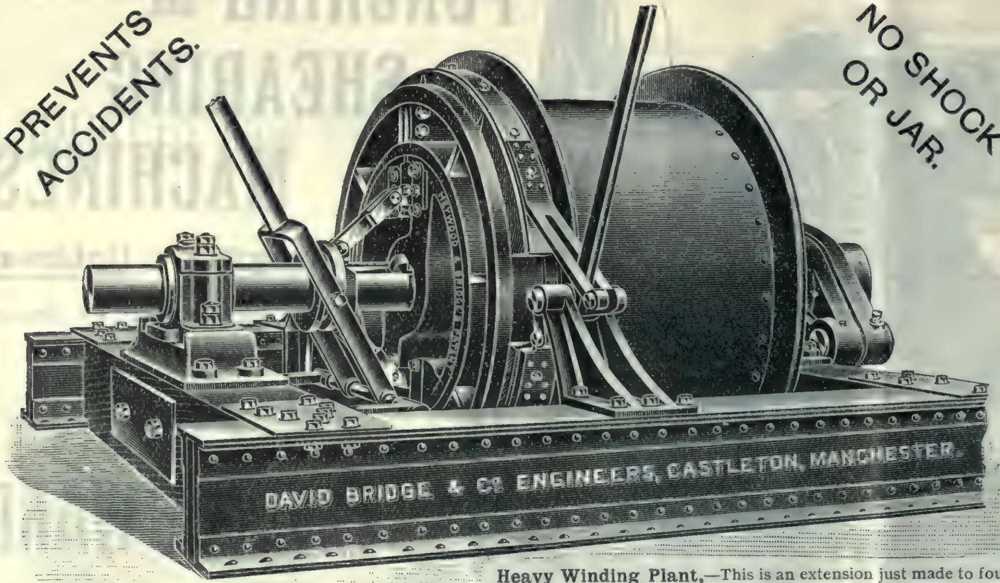
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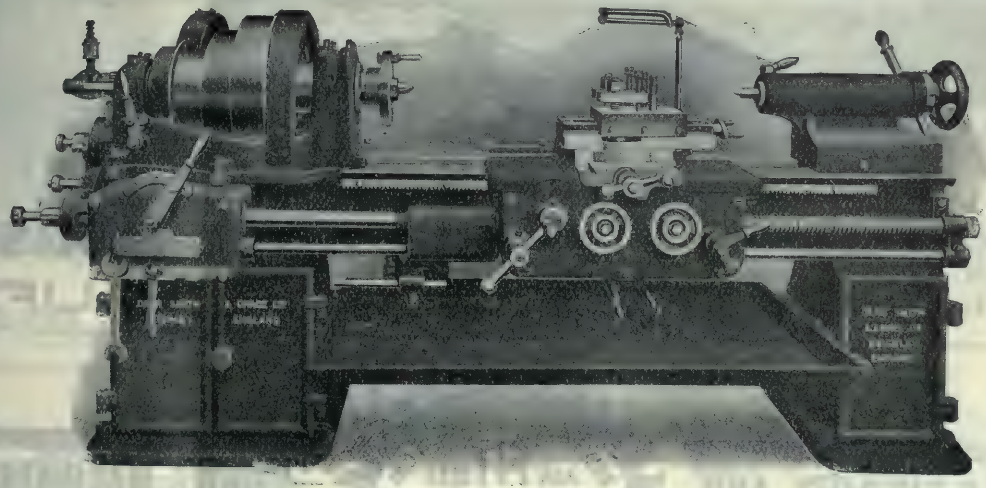

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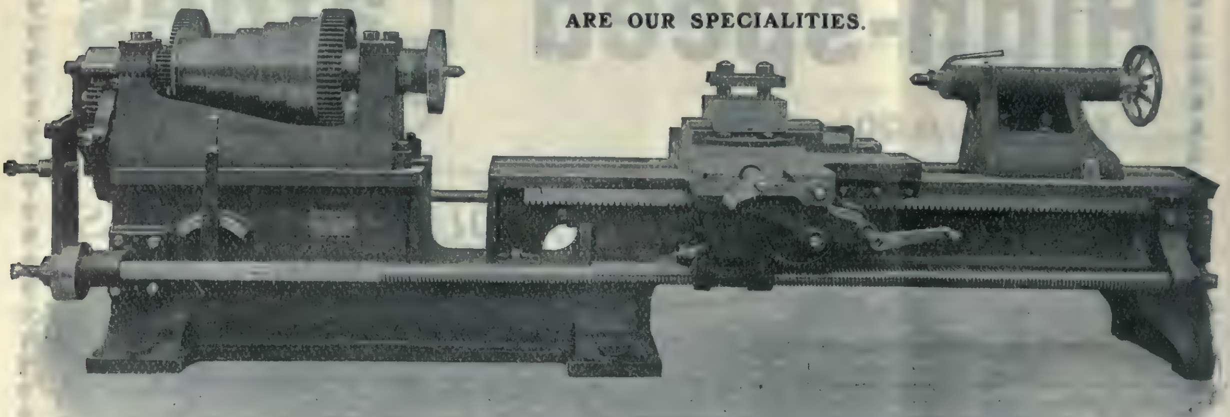

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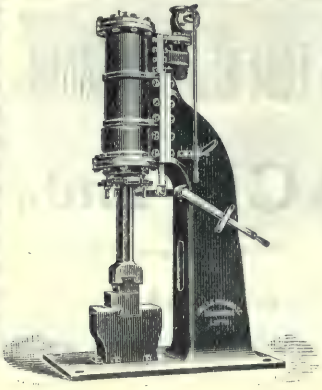

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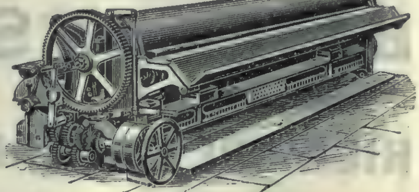

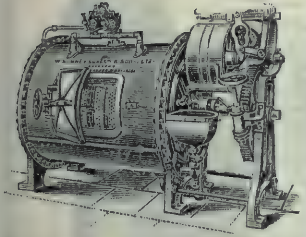

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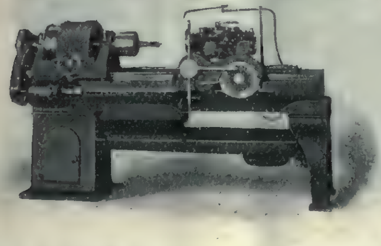

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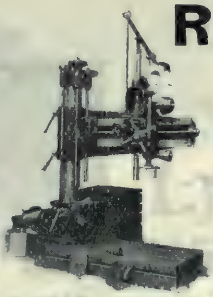

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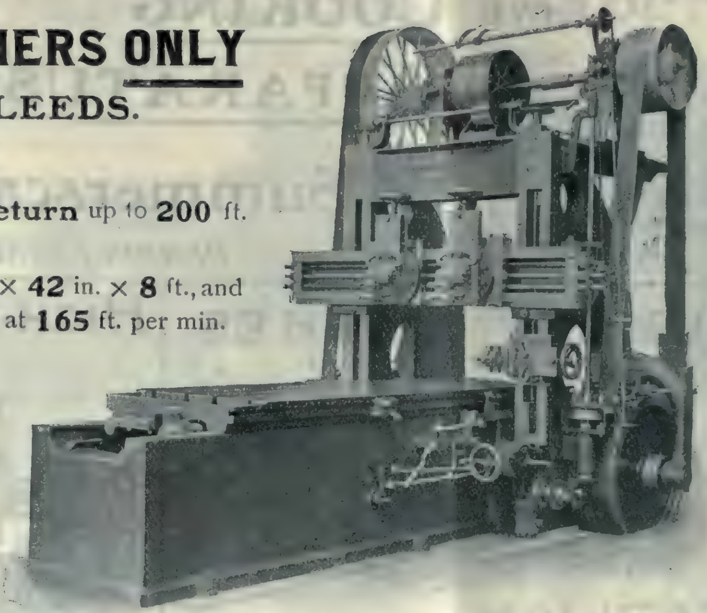

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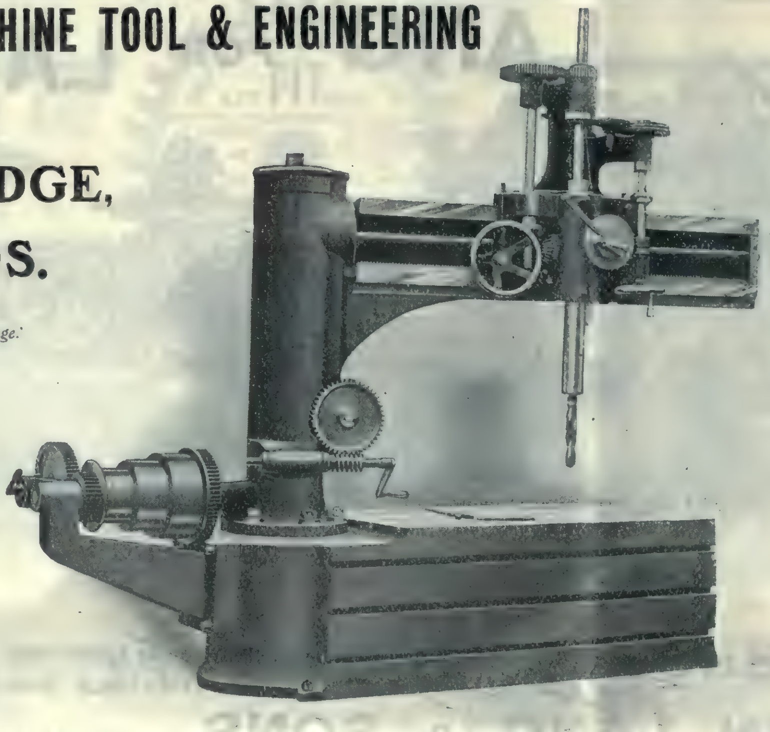

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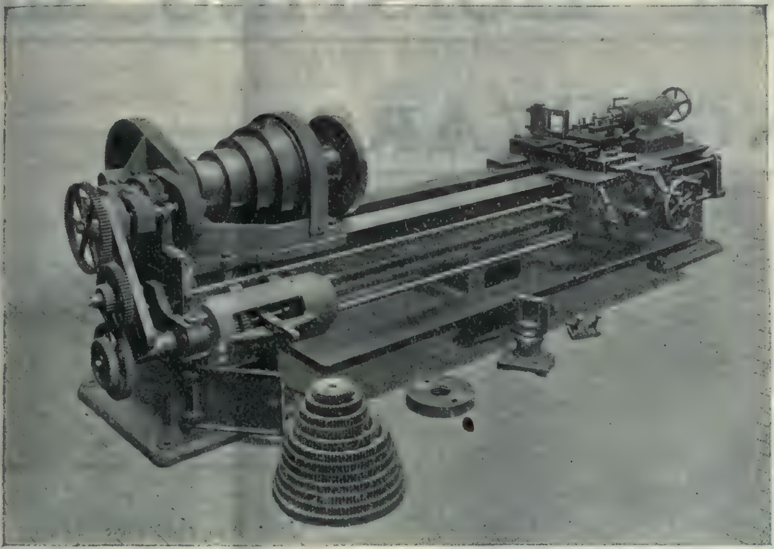

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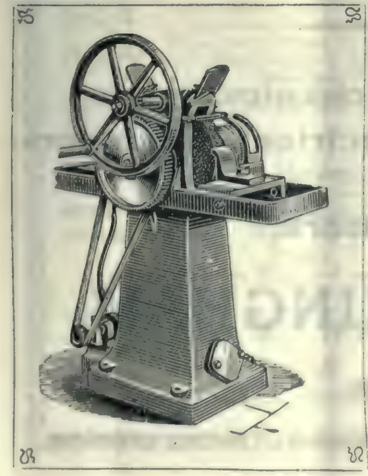

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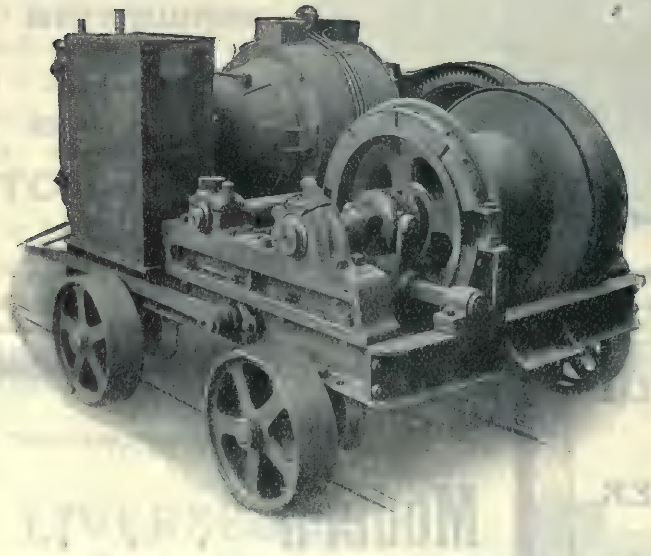

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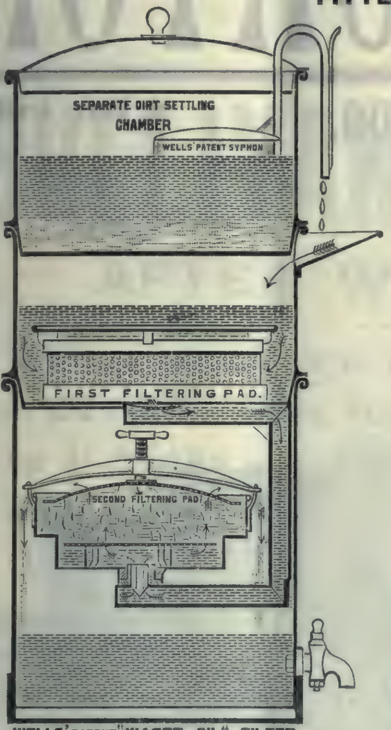

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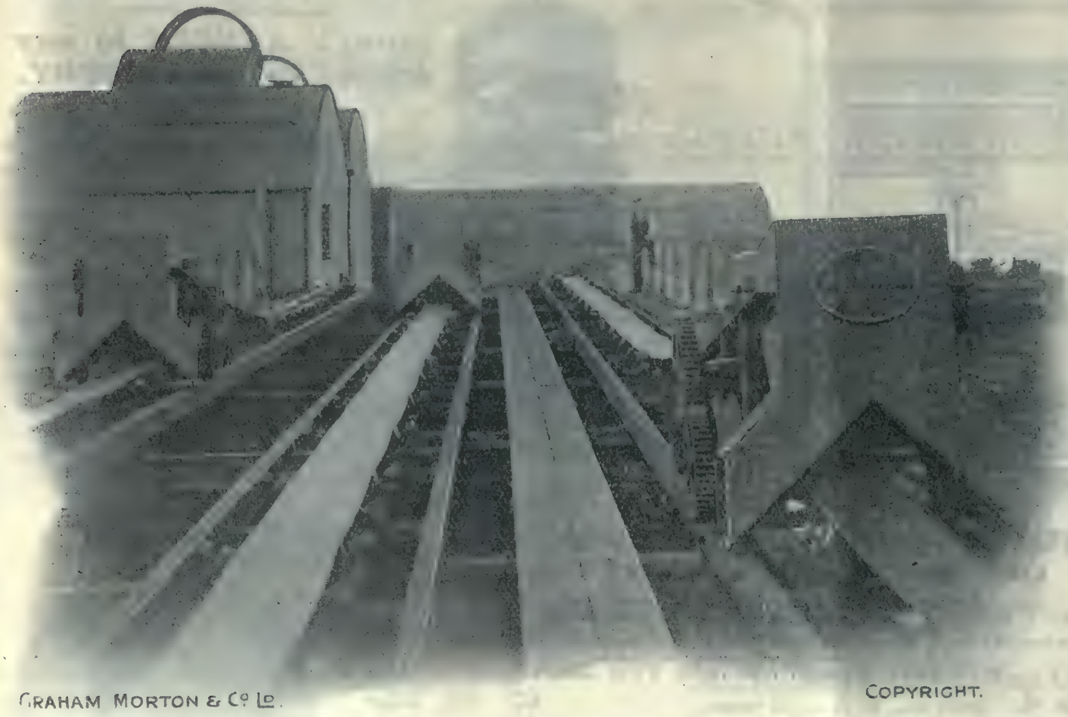

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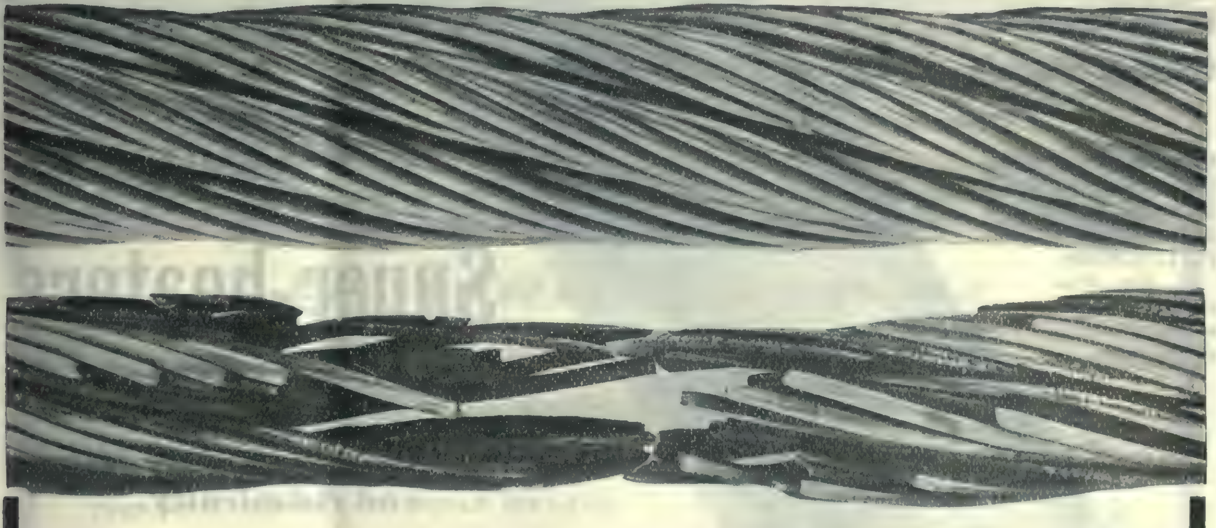

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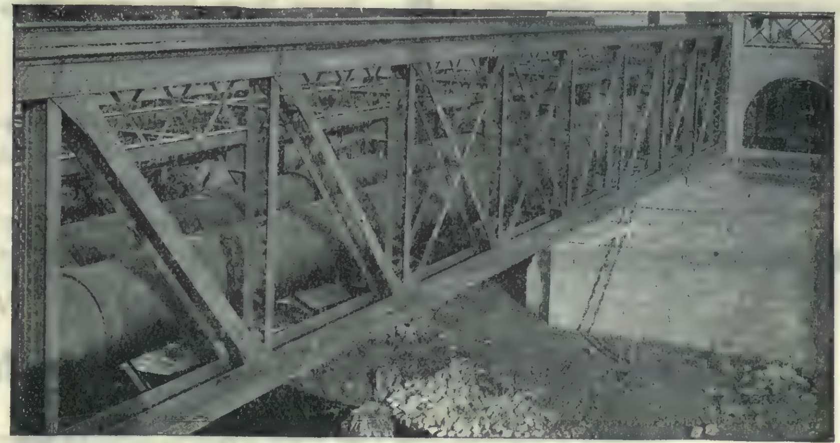

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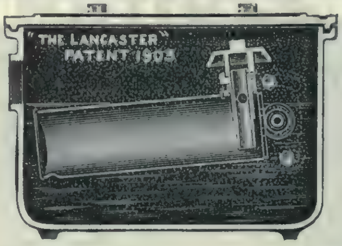

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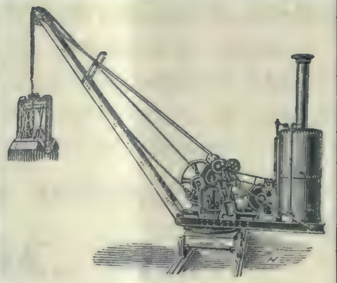

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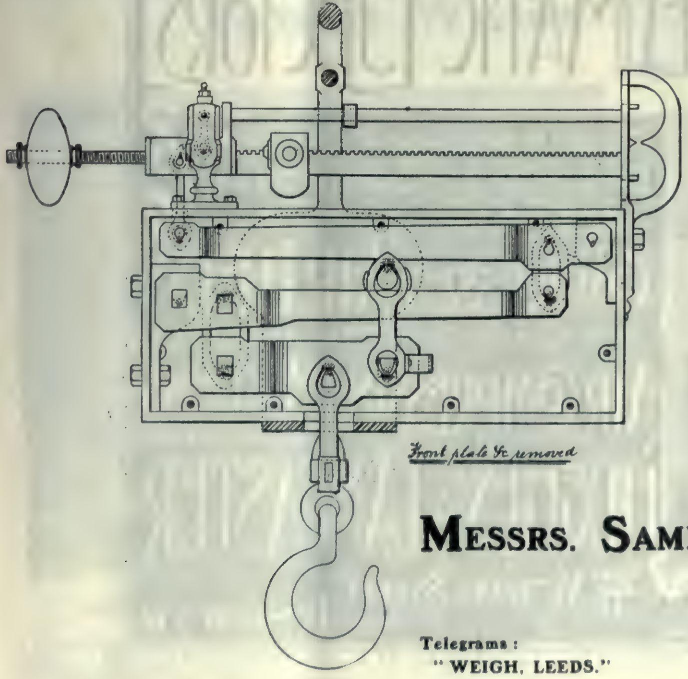

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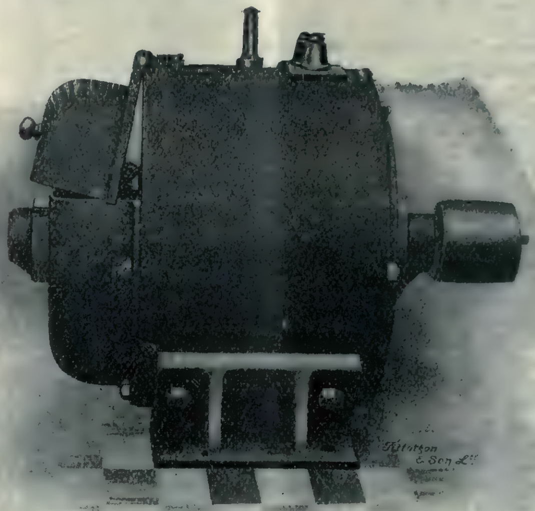

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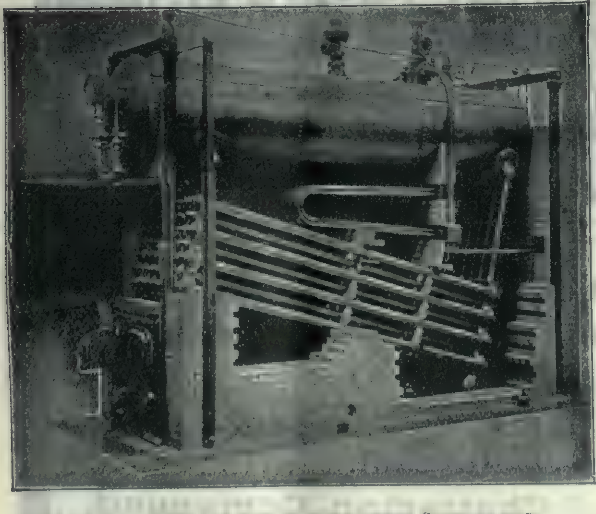

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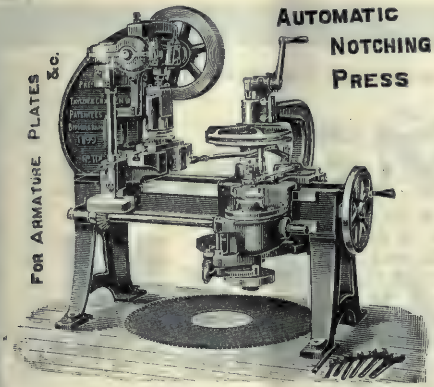

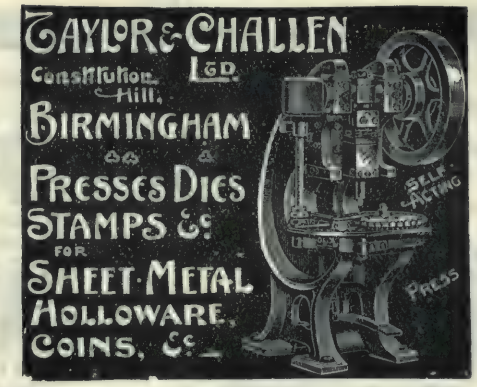

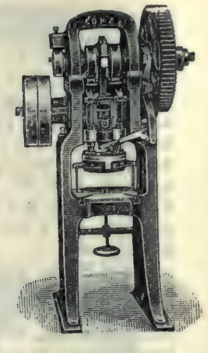

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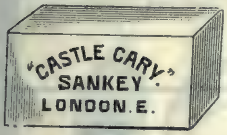
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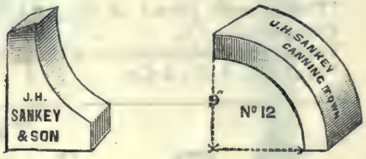

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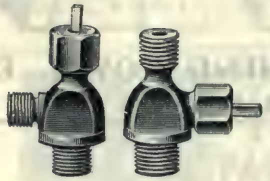

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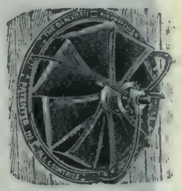

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# PAGE'S WEEKLY Miscellaneous

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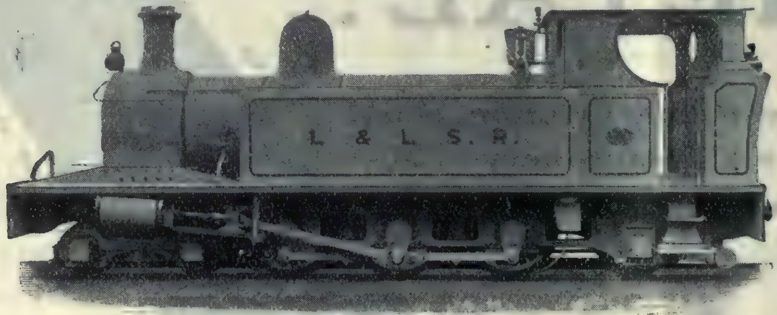

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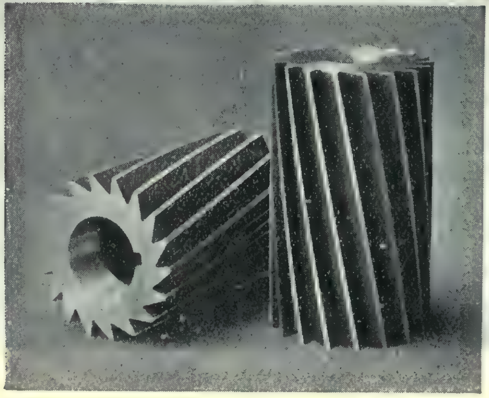

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

Vol. VI. LONDON, FRIDAY, APRIL 14, 1905. No. 31.

## The Offices of "Page's Weekly," Wednesday Evening.

MR. ALFRED MOSELY, C.M.G., of Mosely Commission fame, who lectured on Friday evening at the Royal Institution on "American Industry," is a man of many parts, and judging from an autobiographical sketch which appeared not long ago in "M.A.P.," he has marked literary abilities. Mr. Mosely was born in Bristol, and assimilated Latin and Greek at the Grammar School. His early attempts at the manufacture of hexameters were futile, and have since caused him to raise an emphatic protest against the time wasted on dead languages by boys who are intended for essentially practical avocations. Mr. Mosely records, in the sketch referred to, that he rejected with scorn the offer of a seat in a counting house. He could only picture himself "in heavy boots and a flannel shirt picking glinting jewels out of a sandbank," for it had not yet occurred to him that diamonds are found uncut. Disillusionment naturally awaited him at Kimberley where, at that time each man worked his own claim, taking off his coat and going to work with half a dozen natives at most to help him. Mr. Mosely struck a twelve-carat diamond in the first half hour, but there his luck for the time being ended. He records, however, that in spite of many ups and downs he always stuck to mining with the tenacity of a gambler. "I prospered in my own small way in Kimberley well enough," he says, "and settled in London as a merchant in 1883, keeping, however, in touch with South Africa by frequent trips to and fro. I cannot claim any marked success though I have made sufficient for my reasonable wants with a little to spare, and am now devoting the surplus to what I venture to think

BARON RAYLEIGH, O.M., D.C.L., F.R.S.

The discussion on Electrical Units at the Institution of Electrical Engineers, in which Lord Rayleigh took part, is reported in this issue.

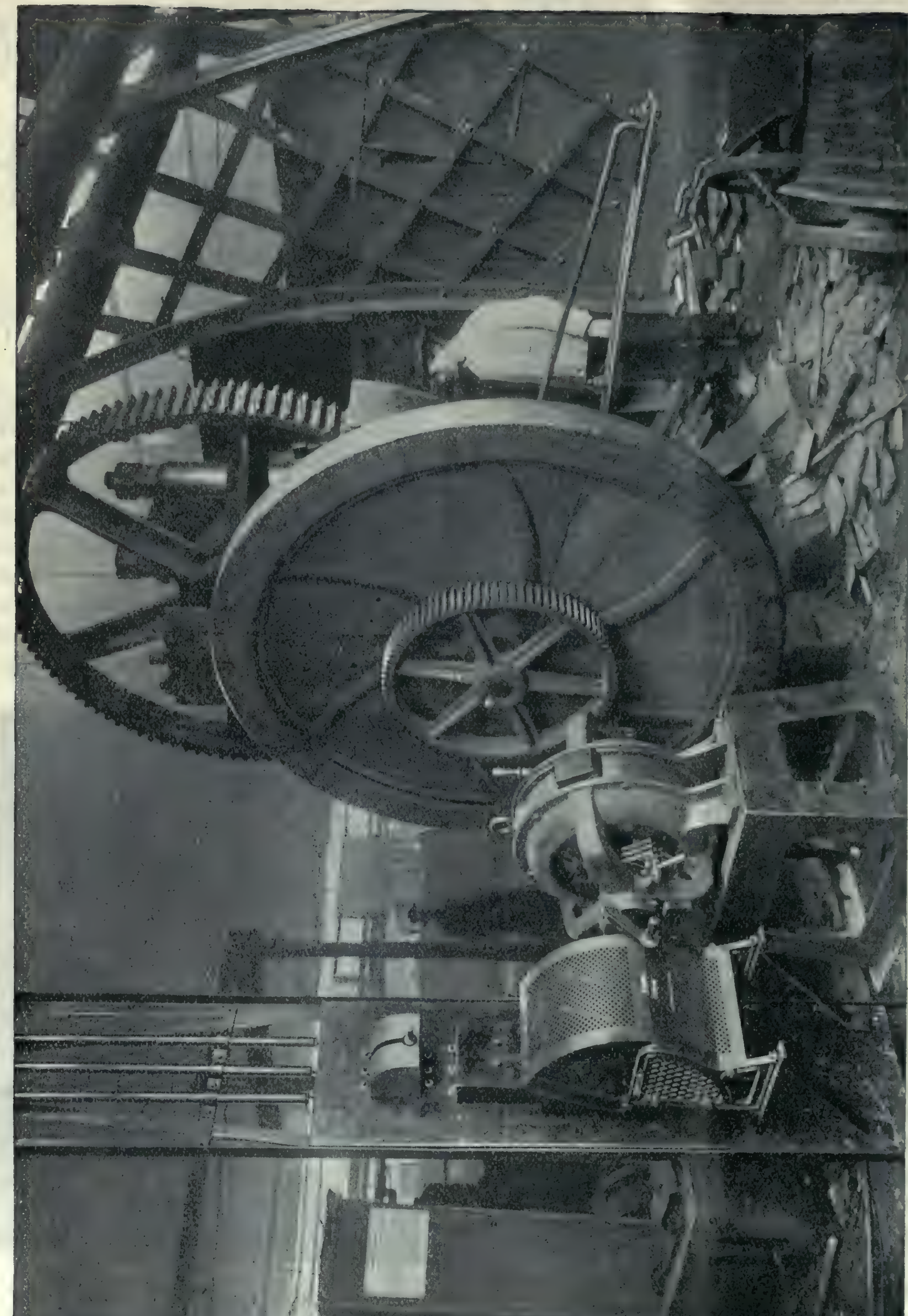

PLATE SHEARS AT MESSRS. BORSIG'S WORKS, BERG AND HUETTENVERWALTUNG O.-S.

10-h.p. 3-phase motor, 330 volts, 1 440 revolutions per minute. Shears by A. Borsig, Berlin. (*See page* 799.)

is useful work." The report of the Mosely Commission offers conclusive evidence of the practical nature of this work. Mr. Mosely's attention was first drawn to the United States by the "alertness, extreme adaptability, and absolute knowledge of the subject in hand shown by American engineers" with whom he came into contact in South Africa. The National Civic Federation and the American Federation of Labour jointly undertook to pilot the Mosely Commissioners through the States, open all doors, and generally ensure the delegates seeing everything worth investigating, and it is well known that all these promises of support and co-operation were admirably fulfilled.

In the course of his lecture on Friday, which dealt with this memorable investigation, Mr. Mosely said he thought something was radically wrong with our system of education, for although we had spent huge sums of money on it we had not got commensurate results. We, and especially our workmen, must realise that the old régime had gone, and we must change to meet changed conditions. This, too, was the case in regard to tariffs. Last week we spoke severely of those who seem ever anxious to relegate our own manufacturing products to a second place, but Mr. Mosely, of course, represents the very antithesis of the kind of pessimisim referred to. He realises, however, the value of the lessons that America has to teach, and has deserved well of the nation for bringing them home to us in an original and practical manner.

We hear so much about a lack of co-operation on the part of employers in the matter of technical education that it is interesting to take a retrospective view of the action of Messrs. Graham, Morton and Co., Ltd., and to see what became of the notable offer which they made last summer to sundry universities. The offer was as follows:—

"Recognising, as we do, the importance of the movement in the great centres of education, which has for its aim the combination of practical with theoretical training for our young men attending British Universities, we are pleased to offer to such as have obtained the B.Sc. in engineering a two or three years' course in practical work in our Drawing Office. We already have one gentlemen taking this course. We are also prepared to pay a small remuneration commencing at 15s. per week first year, 20s. per week second year, and £2 per week third year, to applicants appointed to the vacancies that may from time to time occur here. We think the advantages of a practical course of this kind are too obvious to call for special comment."

This praiseworthy and encouraging offer was made at the crucial moment and upon right lines. It was an offer which was needed to controvert the alleged general apathy of manufacturers and engineers in the matter of technical education. The proposal was made to the Universities of Aberdeen, Birmingham, Cambridge, Durham, Edinburgh, Glasgow, London, Liverpool, Oxford, St. Andrews, Wales and Dublin, the Victoria University of Manchester, Bangor College and the University Colleges of South Wales, Dundee, London and Nottingham. That the offer was hailed with satisfaction by the universities goes without saying. There was a general tendency upon the part of the authorities to make the matter as widely known as possible.

The feeling of the universities was attested by Professor Burstall, of Birmingham University, who told the representative of the Birmingham Gazette that such an offer had not come under his notice before in England.

He remarked, however, that such students as had completed their course were usually well placed with firms who would receive them. Some firms would not take pupils. In America

STEAM MOTOR RAILWAY CAR BY THE AVONSIDE ENGINE COMPANY. (*See page 784.*)

and Germany there was a greater desire on the part of manufacturers to take University and college men, but in Scotland, particularly, and in some parts of England, there were strong prejudices against it. These, the Professor admitted, were not altogether unreasonable. The new firms were the best to take them at present—the motor-car and electrical people—but it was hard to move some of the old manufacturers out of the rut. The shipbuilders along the Clyde would not, for instance, have them, while one of the largest engineering firms in the Birmingham district was equally resolute on this point.

---

We are very pleased to be able to congratulate Mr. Maurice Graham upon the unqualified success of this scheme. His firm have received so many applications from University Students and those who have obtained the B.Sc. in engineering, for admission to the drawing office, that they have had to refuse a very large number, not having sufficient vacancies for desirable applicants. It would be absurd to ignore the fact that manufacturers have in the past shown a certain amount of prejudice against the technical college man, but if Messrs. Graham, Morton and Co., Ltd., having made an experiment on such a large scale, are fully satisfied with the results—and we understand that they are—surely something has been done to kill the prejudice referred to and to straighten out the way for engineering recruits. The conclusion that other firms will see the propriety of adopting a similar course seems irresistible.

---

Messrs. Henry R. Merton and Co. have published their statistics of the world's copper production for 1904. The aggregate output for the twelve months was 613,125 tons, as compared with 574,740 tons for 1903 ; 541,295 tons for 1902, and 479,514 tons for 1900. In ten years the total has nearly doubled, since for 1895 the quantity was no more than 334,565 tons.

# PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

**DAVIDGE PAGE, Editor.**

**Clun House, Surrey Street, Strand, London, W.C.**

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## New Copy for Advertisements,

Alterations, &c., intended for insertion in the current week's issue must be delivered **not later than 4 p.m. on Monday.** If proofs are required the copy and blocks should reach us several days earlier.

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## *MEETINGS FOR THE ENSUING WEEK.*

Friday, April 14th.—Institution of Naval Architects.—North-East Coast Institution of Engineers and Shipbuilders, Newcastle. —Institution of Mechanical Engineers, Storey's Gate, Presidential Address by Mr. Edward Pritchard Martin, 8 p.m.: Resumed discussion on report to Steam Engine Research Committee.—Royal Institution, 9 p.m.: Lord Rayleigh on "The Law of Pressure of Gases below Atmosphere." Physical Society, 8 p.m.: Royal College of Science, Exhibition Road, South Kensington. On Ellipsoidal Lenses," by Mr. R. J. Sowter." The Determination of the Moment of Inertia of the Magnets used in the Measurement of the Horizontal Component of the Earth's Field," by Dr. W. Watson. "Exhibition of a Series of Lecture Experiments illustrating the Properties of the Gaseous Ions produced by Radium and other Sources," by Dr. W. Watson.—Institute of Marine Engineers, Annual General Meeting.

Wednesday, April 19th.—Geological Society of London, 8 p.m.: Chemical Society, Burlington House, 8 p.m.

Thursday, April 20th.—Royal Society, Burlington House, 4.30.

# NEWS ITEMS.

The production of coal throughout the world last year was 864,100,000 tons, as compared with 788,900,000 tons in 1903.

Mr. R. Matthews, of Sir W. G. Armstrong, Whitworth, and Co., has been elected President of the Manchester Association of Engineers.

Mr. H. J. Carnegie-Williams, M.Inst.M.M., has left London on a lengthy professional visit to Ontario and British Columbia.

Mr. George A. Wright, M.Inst.M.M., leaves Singapore in June next, to take over the management of the Totok Mines, Celebes, Dutch East India.

Mr. Arthur J. Bensusan, Assoc.R.S.M., M.Inst.M.M., is leaving London to take up an appointment at the Ouro Preto Gold Mines of Brazil, Passagem, Minas Geraes.

The new sheer-legs at Chatham Dockyard have been tested up to 180 tons at a maximum overhang of 64 ft. from the perpendicular. They are believed to be the largest in the world.

The Parker Foundry Company, of Derby, have appointed Mr. F. A. Porter, of 13, Queen's Square, Belfast, and 35, Parliament Street, Dublin, their representative in Ireland for malleable iron castings.

As we go to press, we regret to hear, that, from some unexplained cause, one of the 150-ton girders employed in the construction of the new bridge over the River Lea and Bow Creek has fallen, blocking up the canal. The bridge was illustrated in a recent number of Page's Weekly.

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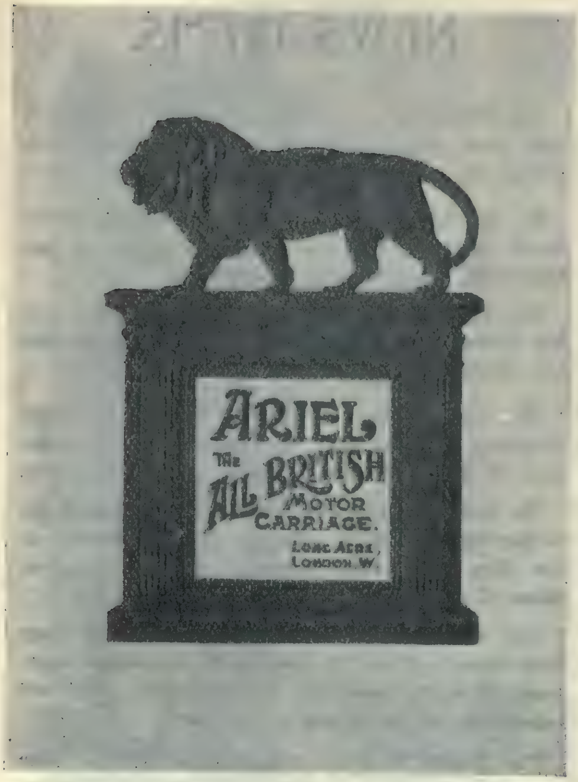


### Catalogue Cover Design.

This effective design is used by a motor company. It is rendered in vermilion (including the lettering), and is embossed upon a thick parchment paper cover. The treatment is at once striking and artistic, and the lion, dominating the design, gives marked emphasis to the fact that the cars described are "all British."

### Steam Railway Motor Car by the Avonside Engine Company.

We illustrate by the courtesy of the Avonside Engine Company of Bristol, one of their most recent steam railway motor-cars (page 782). After careful study of different types the Company have decided that on the whole the car which gives the most economical results and runs the best, is the type which is fitted with the plain locomotive boiler with a copper fire-box and brass tubes. One of the secrets of success lies in the very large proportions of actual heating surface, so that the boiler is never forced, and consequently not only is dry steam produced but the boiler lasts much longer. The engine can be removed from the carriage portion by the use of two jacks and four men in 20 minutes—thus enabling the engine to go into the repair shops without the whole car. It thus takes up less valuable room, and where a number of cars are in use, a spare engine can be put in and the car run again at once. The frame and bogie are of mild steel, and the carriage underframe and bogie are specially designed to prevent undue oscillation.

The carriage portion of the car depends, of course, entirely upon the class of work to be done. Engineer's construction and inspection cars are now made. These are divided into a kitchen, bedroom, and living room, thus enabling the engineer to be quite independent of outside accommodation.

### Catcleugh Reservoir.

A Times correspondent announces that the Newcastle and Gateshead Water Company has just finished a great engineering work which it has had in hand for some years—the construction of a huge reservoir or more properly a natural lake at Catcleugh in Upper Redesdale. There they found a spacious basin surrounded by hills and having one opening towards the south. The engineers have made a dam across the neck of the basin and the reservoir thus fashioned is now filling satisfactorily. The River Rede runs through the basin and the impounding of the flood water is believed to be sufficient for the needs of the district for 30 years to come. The dam is 90 ft. high, 600 yards long from end to end, and 510 ft. wide. A bye-wash has been provided to take away the surplus water. The reservoir is 270 acres in extent; the drainage area is 10,000 acres and the capacity of the lake is 2,345,000,000 gallons. The bye-wash is 200 yards long and is built in sloping terraces to prevent the washing away. The bed is formed of closely set stones on the top of concrete. The bye-wash is spanned by a bridge of five arches built at a cost of £15,000. About 500,000 tons of material were required to build the dam or embankment. It is absolutely impervious to water, and is carried down below the original surface of the ground to rest on suitable foundations. There is a hard core, on either side of which material is packed, the sides being dressed with stone and sloping away at a gradient roughly of one in three. At the bottom there is a stone toe. The daily average accumulation of water is thirteen million gallons, of which three million gallons go to the compensation of riparian owners, the remaining ten millions being sent through a 30-in. pipe 27 miles, to Newcastle. The reservoir is 800 ft. above sea level.

## Iron and Steel Institute.

The annual meeting will be held at the Institution of Civil Engineers, Great George Street, Westminster, on May 11th and 12th.

On the opening day the principal business will be the presentation of the Bessemer gold medal to Professor J. O. Arnold (Sheffield), and the delivery of the presidential address. The annual dinner of the Institute will take place on May 12th.

The following is a list of the papers which will probably be submitted: "On Experiments on the Fusibility of Blast Furnace Slags," by O. Boudouard, D.Sc., Carnegie Research medallist, 1903 (Paris); "On Recent Developments of the Bertrand-Thiel Process," by J. H. Darby (Brymbo), and G. Hatton (Brierley Hill); "On the Application of Dry-air Blast to the Manufacture of Iron," by James Gayley (New York), supplement to paper read on October 26th, 1904; "On the Effect produced by Liquid Air Temperature on the Mechanical and other Properties of Iron," by R. A. Hadfield, president; "On the Cleaning of Blast Furnace Gas," by Axel Sahlin (London); "On the Failure of an Iron Plate through Fatigue," by S. A. Houghton (London); "On the Continuous Steel-making Process in Fixed Open-hearth Furnaces," by S. Surzycki (Czenstochowa, Poland); "On Accidents due to the Asphyxiation of Blast Furnace Workmen," by B. H. Thwaite (London); and "On the Behaviour of the Sulphur in Coke in the Blast Furnace," by Professor F. Wüst, Ph.D., and P. Wolff (Aachen).

Reports on research work carried out during the past year will be submitted by C. O. Bannister (London), J. Dixon Brunton (Musselburgh), H. C. H. Carpenter (Teddington), J. C. Gardner (Oldbury), G. Dillner and A. F. Enström (Stockholm), E. G. L. Roberts and E. A. Wraight (London), Frank Rogers (Cambridge), and Walter Rosenhain (Birmingham), Andrew Carnegie Research scholars.

As already announced in PAGE'S WEEKLY the autumn meeting will be held in Sheffield, from September 25th to 29th, 1905. An influential committee has been formed in Sheffield for the reception of the Institute, with the Lord Mayor as chairman and the Master Cutler as vice-chairman. The chairman of the executive committee is Colonel H. Hughes, C.M.G., the vice-chairman Mr. J. Rossiter Hoyle, the hon. treasurer Mr. Francis Huntsman, and the hon. secretaries Professor J. O. Arnold, Mr. A. McWilliam, and Mr. J. Wortley.

## The Maiden Voyage of the "Victorian."

A very satisfactory account is given of the maiden voyage across the Atlantic of the new turbine-liner *Victorian*. It is stated that an average speed of fully thirteen knots was obtained throughout the passage which was made in bad weather. The Allan Line officials state that the voyage confirms their opinion that the *Victorian* will be able in the best weather to average 18 knots, and in moderately fair weather 17 knots.

## The Institution of Heating and Ventilating Engineers.

The summer meeting of the above institution will be held in Bristol, commencing Tuesday, June 20th. The following day, at the invitation of the president, Mr. George Crispin, the members will visit the new reservoir of the Bristol Waterworks Company, at Blagden, and will also inspect the pumping installation. The Bristol Dock Committee have given permission for the members to inspect the King Edward dock, now in course of construction at Avonmouth. Among other places of engineering interest which the Institution propose to visit are, the Maze Street baths, which were recently erected by the Corporation, the new art gallery, and Clifton suspension bridge.

Professor Barrett, of the Dublin University, has consented to read a paper on "Radiation." Mr. O. M. Row, of Messrs. Royles, Ltd., Manchester, will also contribute a paper. The social side of the meeting includes a number of excursions and a dinner at the Royal Hotel, the headquarters of the Institution during the meeting.

*From The Hardwareman.*

MR. GEORGE CRISPIN.

President of the Institution of Heating and Ventilating Engineers.

### A New Fan.

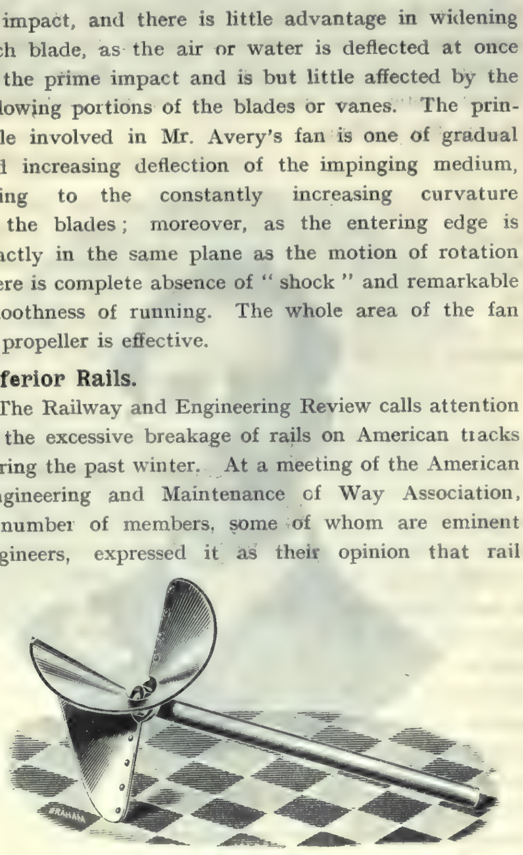
We illustrate herewith a new type of fan and propeller blade which has recently been patented by Mr. A. H. Avery, A.I.E.E., of Tunbridge Wells. The fan has given under test some remarkable results and should be of very general interest to marine and ventilating engineers. The inventor has provided us with the following details of some carefully conducted tests with a small 9-in. flat-blade fan of the ordinary type and a 9-in. fan of the improved pattern:—

| TIP SPEEDS. | RELATIVE EFFICIENCIES. | |
|---|---|---|
| In feet per minute. | 6-blade fan. | Improved fan. |
| 2,000 | 1 | 7 |
| 3,000 | 1 | 2·50 |
| 4,000 | 1 | 2·17 |
| 5,000 | 1 | 2·25 |

The improved fan is quite simple in construction, and consists of a plain circular disc cut radially to the centre, and the two edges thus formed opened out in opposite directions until they lie at right angles to the original plane of the disc. Concerning the claims made for the invention, it is remarked that in propeller blades the maximum effect occurs at the edge of impact, and there is little advantage in widening each blade, as the air or water is deflected at once at the prime impact and is but little affected by the following portions of the blades or vanes. The principle involved in Mr. Avery's fan is one of gradual and increasing deflection of the impinging medium, owing to the constantly increasing curvature of the blades; moreover, as the entering edge is exactly in the same plane as the motion of rotation there is complete absence of "shock" and remarkable smoothness of running. The whole area of the fan or propeller is effective.

### Inferior Rails.

The Railway and Engineering Review calls attention to the excessive breakage of rails on American tracks during the past winter. At a meeting of the American Engineering and Maintenance of Way Association, a number of members, some of whom are eminent engineers, expressed it as their opinion that rail metal has been growing worse from year to year, particularly since the years 1899 or 1900. One of the managers of a large railway system stated that as many as 123 rails laid during the past season had broken under trains within a short time this winter, and in two cases broken rails had caused expensive damage in freight-train wrecks. These broken rails comprised about 15 per cent. of the whole number laid. Representatives of two other large railway systems spoke of great trouble with piped rails breaking under heavy traffic, and in particular instances the character of the break had shown extremely brittle material for rail steel. The trend of the discussion was to the effect that rails have been breaking at an alarming rate and it is now high time that some improvement in manufacture must be enforced. It is alleged that inferior material is being used at the rolling mills by incorporating in the finished material an undue proportion of the spongy portion at the top of the ingot.


MR. AVERY'S NEW FAN AND PROPELLER BLADE.

### Qualifications for Engineers.

Professor H. N. Waynforth has been discussing in the column of a daily contemporary the "huge field" open to young men in the engineering profession. It is, he says, yearly becoming more and more essential that the engineer shall have a technical training as well as experience in actual works, and this is very forcibly brought home by the fact that for a great many positions it is now necessary that the person appointed shall have obtained the diploma of some recognised engineering college, or shall have passed some such qualifying examination as that of the Institution of Civil Engineers. But something beyond all this is required by the man who is to become a successful engineer; he must have had a good general education, and be capable of taking his place in any society. He must possess in a marked degree sound business principles, and, above all, a knowledge of men and how to manage them. He must further have great patience, perseverance, and power of initiative, as it is only by the exercise of these qualities that he will be able to overcome the difficulties with which he is continually confronted.

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A Laffan telegram from Pittsburg says the biggest coal contract ever made in the United States will be signed in a few days, when the Pittsburg Coal Company will undertake to furnish the United States Steel Corporation with from six to ten million tons every year for twenty-five years at a fixed price. The total amount of money involved will average twenty million dollars a year (£4,000,000).

# INSTITUTION OF NAVAL ARCHITECTS.

THE annual meeting of this Institution was held in the Hall of the Society of Arts on Wednesday. The Earl of Glasgow presided, and among those present were Admiral Sir John Dalrymple Hay, Sir William White, Sir John Williamson, Admiral C. P. Fitzgerald, Dr. Elgar, Mr. J. H. Cornish, Sir John Thornycroft, and Mr. A. F. Yarrow.

The annual report stated that the Institution had during the past year continued to make satisfactory progress. A step in the development of the organisation of the Institution was the formation of the Student class of Members. The Council had had under consideration during the past year the question of the alteration of the rules for the election of Vice-Presidents and Members of Council, and, following the recommendations of a representative committee of their body had drawn up certain amendments to the rules. By these new rules, if adopted, the Council hoped to widen the basis of representation upon the Council; and to provide, without detracting from the distinction of the office, for a more regular flow of promotion of Members of Council to the office of Vice-President. In accordance with the resolution passed at the last annual meeting of the Institution, the Council had appointed a committee, including representative shipowners and members of the Institution, to consider a scheme for the establishment (in connection with the National Physical Laboratory at Bushey) of an experimental tank for research work in the resistance and propulsion of ships.

Conditional promises had been received amounting to an aggregate of about £6,000 out of the £15,000 required for the construction of the tank, together with certain premises of annual subscriptions towards the cost of maintenance over a term of years. Further steps would be taken as soon as appeared desirable.

The Council record with deep regret the death of a distinguished Vice-President, the Earl of Northbrook. A vacancy being thus created in the list of non-professional Vice-Presidents, the Council had unanimously elected the Earl of Selborne to that office. Among the other deaths that have occurred during the past year are those of Messrs. G. L. Watson, the well-known yacht designer; of Mr. Beauchamp Tower, whose researches into the problems connected with the motion of ships at sea formed the subject of interesting contribution to the Transactions; of Mr. W. H. Wilson, of Messrs. Harland and Wolff; of Mr. R. S. Scott, of Greenock; of Mr. H. G. Spence, of Stockton-on-Tees; and of Mr. F. T. Marshall, of Messrs. Hawthorn, Leslie and Co., whose early death ended prematurely a career that was full of promise; while among the Associates occur the names of Admiral Church and Mr. A. G. Dryhurst, for many years Secretary to Lloyd's Register Society.

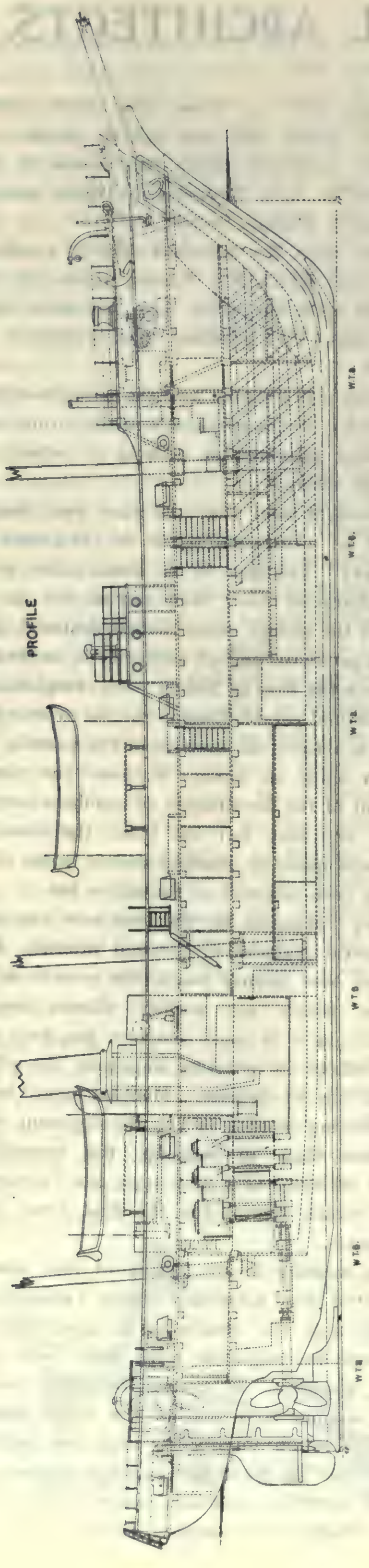
Following upon the generous offer of a scholarship of £50 a year which Mr. Yarrow made last year, a second offer upon the same lines has been made by Dr. F. Elgar, Vice-President and Treasurer of the Institution.

The report was adopted and the amendments to the rules carried. At the conclusion of the formal business the President delivered his address of which the following is an abstract:—

The President said that the past year may fairly be classed as a memorable one in the annals of the Royal Navy. Changes of a remarkable and far-reaching character have been carried out in various branches of the service, some of them destined, perhaps, as has been predicted on high authority, to be the greatest reforms since the time of Nelson: the completion of the new educational establishments for the training of our future naval officers, the revision of the periods of commission for ships on foreign stations the timely re-arrangement of the distribution of our fleets throughout the world, and last, but not least, the clean sweep that has been made of obsolete vessels, some of which had so long been retained on the active list.

The Navy Estimates for the year now commencing present several features of unusual interest. For the first time in over twenty years, the growth of naval expenditure, which, not without reason, had been viewed with alarm in many quarters, has been stayed, and that without in any way impairing the efficiency of our first line of defence. Mention might be made of an interesting feature in the development of that most modern class of warship, the torpedo-boat, namely the inclusion of a new type, the "ocean-going destroyer," which figures for the first time in this year's estimates.

Since the meeting in the spring of last year, the final report of the Admiralty Boiler Committee has been issued, and the results of a most important and thorough investigation have thus been placed before the country. It cannot be said, however, that their labours have settled the boiler question, because there is no finality to inventive ingenuity, but at any rate we have now surer foundations than before upon which to base our, more or less, varied opinions. Admiral Sir Compton Domvile, the chair-



THE S.S. "DISCOVERY."—PROFILE.

man of the Committee, in a covering letter accompanying the final report, bears testimony to the satisfactory working of the boilers fitted in the ships under his command on the Mediterranean Station. This act of justice is, however, only retrospective in its practical effect, for the Boiler Committee have two other types of water-tube boilers before the Belleville design. These two types are the Babcock and Wilcox boiler, and the Yarrow boiler. What type will ultimately prevail is a question that time will solve.

The successful passage of the first turbine-engined steamer to cross the Atlantic Ocean marks an epoch in the history of Transatlantic navigation, and is a fresh triumph for the marine steam turbine.

The other most important engineering event of the past year as regards the steam turbine has been the trials of H.M. third-class cruiser *Amethyst*. An excellent opportunity was thus given for estimating the efficiency of the Parsons steam turbines, with which she was fitted. The cruisers of this class are 360 ft. long, 40 ft. wide, and about 3,000 tons displacement. Their estimated speed was $21\frac{3}{4}$ knots with 9,800 i.h.p. It is, of course, impossible to take indicator diagrams in the ordinary way from turbine engines, but we may judge of the performance by the rough test of speed. Vessels of this class fitted with ordinary reciprocating engines will steam about $22\frac{1}{2}$ knots as a maximum, but the *Amethyst* made over $23\frac{1}{2}$ knots, the actual advantage being 1·29 knots.

At the higher speeds the turbine machinery appears decidedly more economical in fuel, whilst at lower speeds the reciprocating engines have the advantage. At 10 knots a ton of coal would, according to published figures, carry the *Amethyst* 7·42 miles, whilst the *Topaze*, a sister ship with reciprocating engines, would, on the same consumption, steam 9·75 miles; the difference in favour of the reciprocating engine being $2\frac{1}{3}$ miles. That is a very substantial advantage. At 14 knots the superiority of the older type of engine is less marked; it has fallen, in fact, to one-fifth of a mile, the miles steamed per ton of coal being respectively 6·6 and 6·8. An increase of another 4 knots in speed quite reverses the position, for at 18 knots the *Amethyst* steamed 4.8 miles for a ton of coal burnt, and the *Topaze* 3·7 miles, a difference of $1\frac{1}{10}$ miles in favour of the turbine. At 20 knots the *Amethyst* ran 4·22 miles, and the *Topaze* 2·9 miles per ton of coal burnt. At 23·6 knots, a speed the *Topaze* did not reach, the *Amethyst* would steam a little over 2 miles per ton of coal, whilst at 22 knots the *Topaze* would cover 1·89 miles per ton.

# ON THE DESIGN OF THE ANTARCTIC EXPLORATION VESSEL "DISCOVERY."

THE author of this paper, Mr. W. E. Smith, C.B., as naval architect to the *Discovery* expedition, placed before the Association full constructional details of this now famous vessel, which, as our readers will remember, was constructed specially for the exploration of the South Polar Regions. The history of the vessel, step by step, was stated, and the paper included a full specification with drawings, so that the next ship constructed for Polar work will have the advantage, not only of the points in the *Discovery* that proved excellent, but will also profit as regards points which can be improved upon. Says Mr. Smith :—

So far as I have been informed on the subject, the *Discovery*, in the main, answered her purpose very well ; but, in building a succeeding vessel we ought to try and do better still, and the following notes on this point are added for the benefit of those who come after.

Besides the question of bilge keels, there are some other points on which I suggest it would be possible to make improvements. The system of lagging applied under the upper deck could, I think, be applied with advantage to the entire contour of the sides in the living space. Thick as the sides of the ship were, the cold was so intense that the moisture of the interior sometimes readily condensed over the inner ends of bolts and caused some amount of discomfort that ought not to be repeated.

### PREPARATIONS FOR MAGNETIC WORK.

As regards the preparations made for the important magnetic work of the expedition, it was desired in some quarters that the vessel should be entirely free from magnetic qualities. This, however, was a counsel of perfection not then, nor even yet, realisable. Marine engineers do not make their engines and boilers free from magnetic properties, and till they do so, we cannot have a ship with engines on board with freedom from magnetic properties.

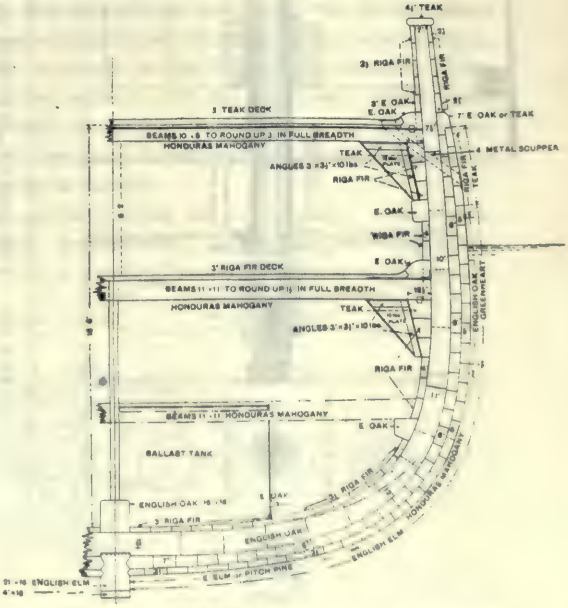
I have, however, seen very useful steel made by Messrs. Hadfield, of Sheffield, suitable for certain purposes, and entirely devoid of ordinary magnetic properties, and in any future ship, in which non-magnetic properties are desired, possibly something might be done towards ensuring such properties by the use of such steel.

As an example of the purposes for which such steel might have been usefully employed, I may mention that one of the warming stoves in the men's quarters was built of brass casing, with fire-brick lining, so as to cause no magnetic disturbance. This stove rapidly burnt out, and an improved stove casing had to be made during the continuance of the expedition. Had I then known of Messrs. Hadfield's non-magnetic steel, I should have had the stove casing made of this material, instead of brass. The stove would have been more useful, and there would have been one item less for the ship's complement to deal with.

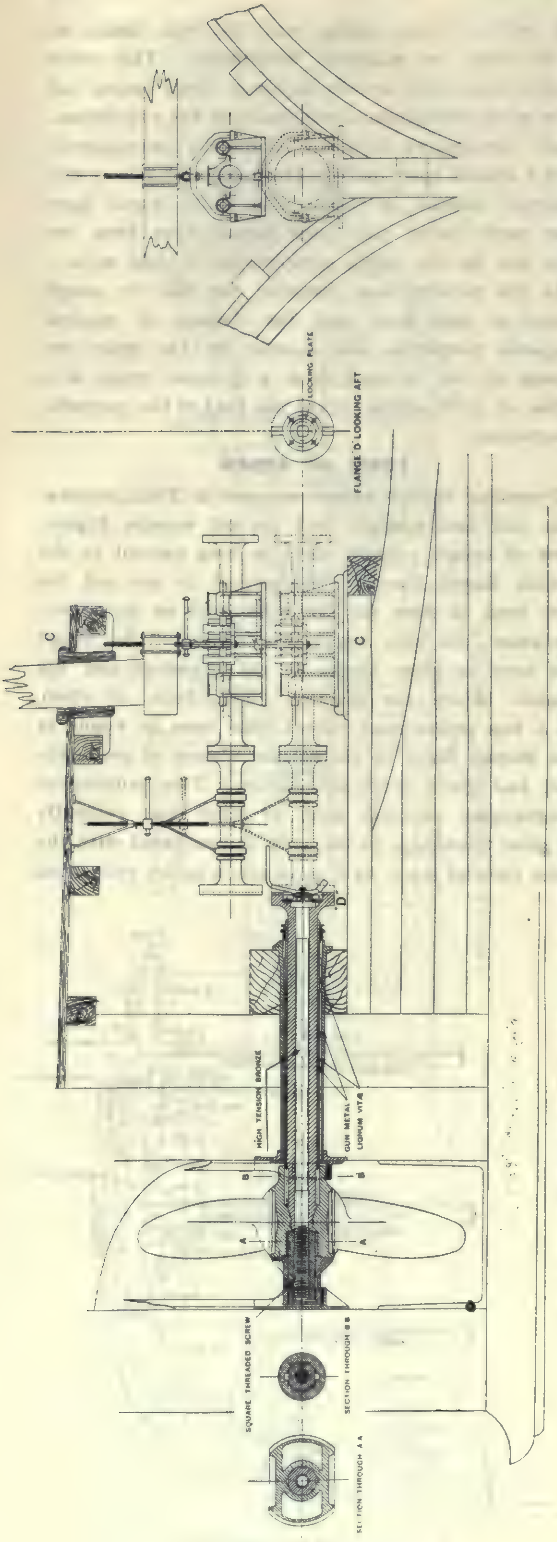
In the present case, however, we had to accept things as they were, and the absence of marked magnetic properties was ensured by the entire exclusion of iron or steel from a globular space of a radius of 30 ft., whose centre was that of the magnetic observatory.

### FORM OF STERN.

Preceding British vessels engaged in Polar exploration, and also whalers, had the old wooden frigate form of square counter stern so long current in the British Royal Navy. This seemed to me not the best form of stern for the work, and on my representation the ship committee consented to adopt the form of stern shown in the drawings and the models before the meeting. This form of stern, to a less pronounced extent, had been in vogue in the British Navy in the smaller classes of gunboats, and had given great satisfaction. This pronounced overhanging rounded form of stern was evidently of great advantage in ice work as compared with the older form of stern, as it gave much better protection



THE S.S. "DISCOVERY."—MIDSHIP SECTION.



SECTION THROUGH C. C.

THE S.S. "DISCOVERY."—METHOD OF ATTACHING PROPELLER.

to the rudder, rudderpost, and screw than did the old form of stern, and this feature was abundantly illustrated when the vessel got into the ice; but I was of opinion also that in the case of the new *Discovery*, practically a sailing ship, where the helmsman had of necessity to be right aft in order that he might keep his eye on the sails, this form of stern would be more satisfactory in heavy seas, and that the helmsman would be drier and would soon see that he was better circumstanced and less likely to be exposed to a green sea in heavy Antarctic gales than in a vessel with the old form of stern.

### METHOD OF LIFTING AND SECURING RUDDER.

Anyone who has experienced the difficulty of shipping an ordinary boat's rudder when afloat with any sea on, will know how difficult it sometimes is to properly engage the pintles and braces. It is often a necessity to unship the rudder of a Polar exploration ship to secure its safety, and it becomes an equal necessity to ship it again thereafter to bring it into use. The method adopted was as shown in the accompanying drawing. This method was very effective. No skill of any sort was needed on the part of the operators; the rudder was simply entered into the rudder aperture and lowered into place, when it automatically felt its way into the brace.

A spare rudder, which did not depend on the lower pintle, and which would be quite efficient in the event of the carrying away of the rudder post, was provided as part of the equipment; but, although this spare rudder was used for a short time whilst the main rudder was under repair, the rudder post remained intact throughout the voyage, and the main rudder was, therefore, in use nearly the whole of the time.

### THE MACHINERY OF THE "DISCOVERY."

The main machinery and boilers were constructed by Messrs. Gourlay Bros., Dundee. Steam is supplied by two cylindrical boilers 10 ft. 3 in. in diameter each, with two furnaces; the combined total grate surface provided is 67 square feet. The maximum working pressure is 150 lb. per square inch. The engines are of the triple-expansion type designed to develop 450 h.p. when working at about 90 revolutions per minute. The diameters of the cylinders are: High-pressure, 14½ in.; intermediate-pressure, 22½ in. low-pressure, 36 in.; length of stroke, 30 in.

The high and intermediate-pressure slide valves are of the piston type, the low-pressure being a flat valve; they are actuated by the usual link motion. The condenser cooling surface is 560 square feet. The main air, feed, and bilge pumps are worked from levers off the high-pressure engine. The shafting is of steel, the crank shaft arms being forged in one with the shaft. The propeller is two-bladed, of the following proportions: Diameter, 10 ft. 6 in.; pitch, 12 ft. The boss is of gun-metal, and the blades are of high tension brass.

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# THE ARMOURED CRUISERS "KASUGA" AND "NISSHIN" OF THE IMPERIAL JAPANESE NAVY.

Much has been written in the technical press from time to time on the subject of these cruisers, but members had now the advantage of hearing a complete account of the vessels by Colonel Soliani.

The cruisers *Kasuga* and *Nisshin* are the last of a series of sister ships (ten in number) stretching over a period of about eleven years, from 1893 to 1904. They had a prototype in the earlier Italian cruisers *Carlo Alberto* and *Vittor Pisani*, which, except that the armament was less powerful, were of practically the same design. As a main armament, the *Carlo Alberto* and *Vittor Pisani* had twelve 6-in. guns, while the *Garibaldi* (the first of the list of the *Kasuga* and *Nisshin* type had two 10-in. guns and ten 6-in. guns. But, as a compensation, the former ships had a long forecastle, which made them more suitable to ocean steaming and long commission on distant stations.

It is well known that the transfer to the Japanese Government of the *Kasuga* and *Nisshin*, which, under the names of *Rivadavia* and *Moreno*, were built for the Argentine Government, was mainly due to the same circumstances as caused the battleships *Triumph* and *Swiftsure* to pass from the Chilian to the British Navy.

The ships are three-decked; viz., in addition to the armour deck they have a lower deck, which in the central part of the ship combines with the armour deck; a main deck and a flush upper deck. They may be said to be symmetrical fore and aft; the propelling engines occupy the central part, and the boilers are in two equal groups, one forward and one abaft the engines, while the armament is also equally distributed forward and aft. The ships have one mast only, placed in the middle of the length.

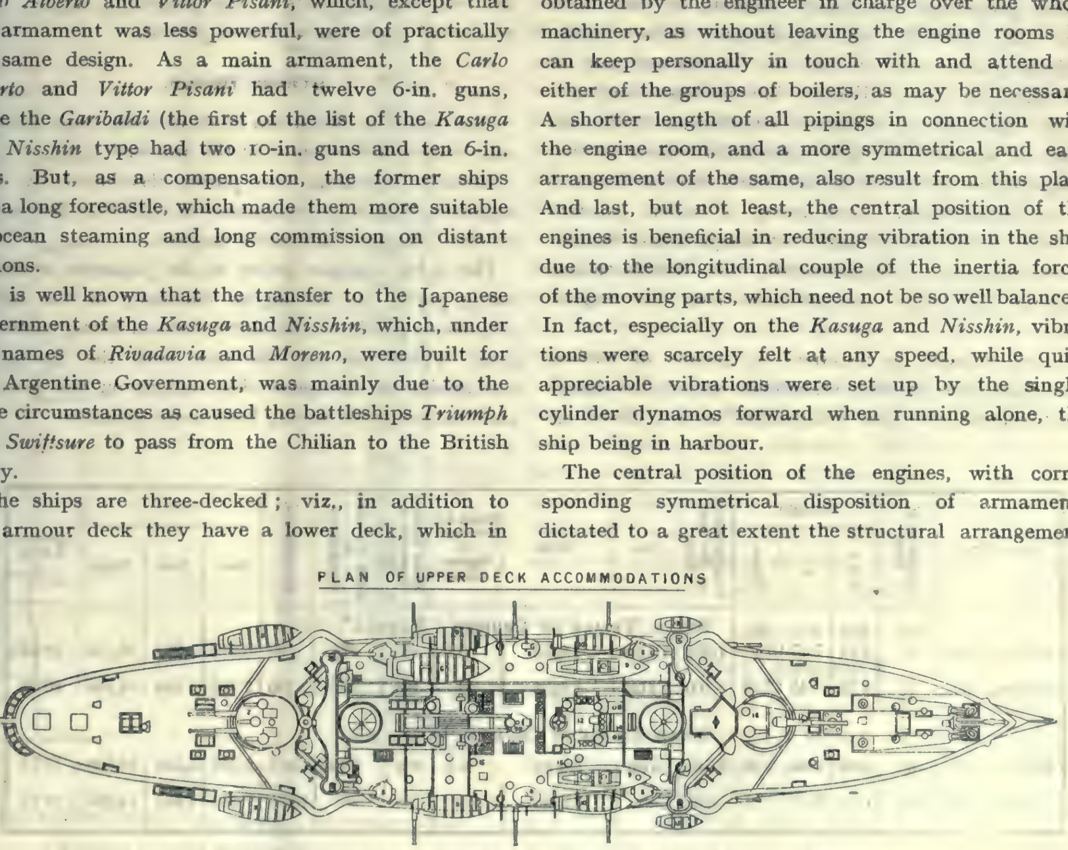
### ARRANGEMENT OF ENGINES.

The location of the propelling engines is in the middle, while not free from inconvenience, as it entails a greater length and weight of shafting, and a higher position of the after boilers, which are necessarily fitted above the shaft tunnels, has some important advantages. First, it affords a real duplication of the steaming power, one group of boilers being entirely separated from the other group, with no connection whatever so that any damage affecting one of them, whether in the boilers or in the steam and feed pipes, cannot in any way affect the other group.

Greater facility of supervision and direction is obtained by the engineer in charge over the whole machinery, as without leaving the engine rooms he can keep personally in touch with and attend to either of the groups of boilers, as may be necessary. A shorter length of all pipings in connection with the engine room, and a more symmetrical and easy arrangement of the same, also result from this plan. And last, but not least, the central position of the engines is beneficial in reducing vibration in the ship due to the longitudinal couple of the inertia forces of the moving parts, which need not be so well balanced. In fact, especially on the *Kasuga* and *Nisshin*, vibrations were scarcely felt at any speed, while quite appreciable vibrations were set up by the single-cylinder dynamos forward when running alone, the ship being in harbour.

The central position of the engines, with corresponding symmetrical disposition of armament, dictated to a great extent the structural arrangement

PLAN OF UPPER DECK ACCOMMODATIONS



"KASUGA" AND "NISSHIN."

| Original Name. | Final Name. | Builder. | Date of launch. | Type of Boilers. | Displacement metric tons. | I.H.P. Specified metrical. | Armaments. | |
|---|---|---|---|---|---|---|---|---|
| Giuseppe Garibaldi | Garibaldi | Ansaldo | 1895 | Cylindrical | 6,840 | 13,000 | 2 10″, 10 6″, 6 4·7″ | 22 minor guns.<br>4 above-water torpedo tubes. |
| Varese | San Martin | Orlando | 1896 | " | 6,882 | 13,000 | " " " | 24 minor guns.<br>4 above-water torpedo tubes. |
| Giuseppe Garibaldi | Cristobal Colon | Ansaldo | 1896 | Niclausse | 6,840 | 13,000 | " " " | 22 minor guns.<br>4 above-water torpedo tubes. |
| Varese | General Belgrano | Orlando | 1897 | Belleville | 6,900 | 13,000 | 2 10′, 14 6″ | 24 minor guns.<br>4 above-water torpedo tubes. |
| Giuseppe Garibaldi | Lueyrredon | Ansaldo | 1898 | " | 6,840 | 13,000 | 2 10″, 10 6″, 6 4·7″ | 22 minor guns.<br>4 above-water torpedo tubes. |
| " | Giuseppe Garibaldi | " | 1899 | Niclausse | 7,400 | 13 500 | 1 10″, 2 8″, 14 6 | 20 minor guns.<br>4 above-water torpedo tubes. |
| Varese | Varese | Orlando | 1899 | Belleville | 7,400 | 13,500 | " " " | 20 minor guns.<br>4 above-water torpedo tubes. |
| Ferruccio | Ferruccio | R. Dock-yard of Venice | 1902 | Niclausse | 7,400 | 13,500 | " " " | 20 minor guns.<br>4 above-water torpedo tubes. |
| Rivadavia | Kasuga | Ansaldo | 1902 | Cylindrical | 7,710 | 13,500 | " " " | 20 minor guns.<br>4 above-water torpedo tubes. |
| Moreno | Nisshin | " | 1903 | Cylindrical | 7,745 | 13,500 | 4 8″, 14 6″ | 20 minor guns.<br>4 above-water torpedo tubes. |

In order of date, the ten sister ships, with their principal characteristics stand as above. In all ships the main armament of 10-in. guns and 8-in. guns is carried in two revolving turrets, one forward and one aft.

of the ships, which is, however, on the whole, the same as is usual in ships of their size and class.

The propelling machinery consists of two twin sets of vertical triple-expansion three-cylinder engines, located side by side in the central part of the ship, in two adjacent independent compartments separated by a central longitudinal bulkhead. Steam is supplied by eight cylindrical boilers in two groups of four boilers each, one abaft and one forward of the engine-room. Each group of boilers consists of two double-ended and two single-ended boilers in two separate compartments, the double-enders being in the large compartment near the engine room.

Forced draught is obtained by means of twelve steam fans, two in each stokehold, under the closed ashpit system, the fans being fitted as low down as possible, to ensure good ventilation of the stokehold. Care has been taken to balance as well as possible the reciprocating parts of the propelling engines, but no special contrivance was employed.

### STEAM TRIALS.

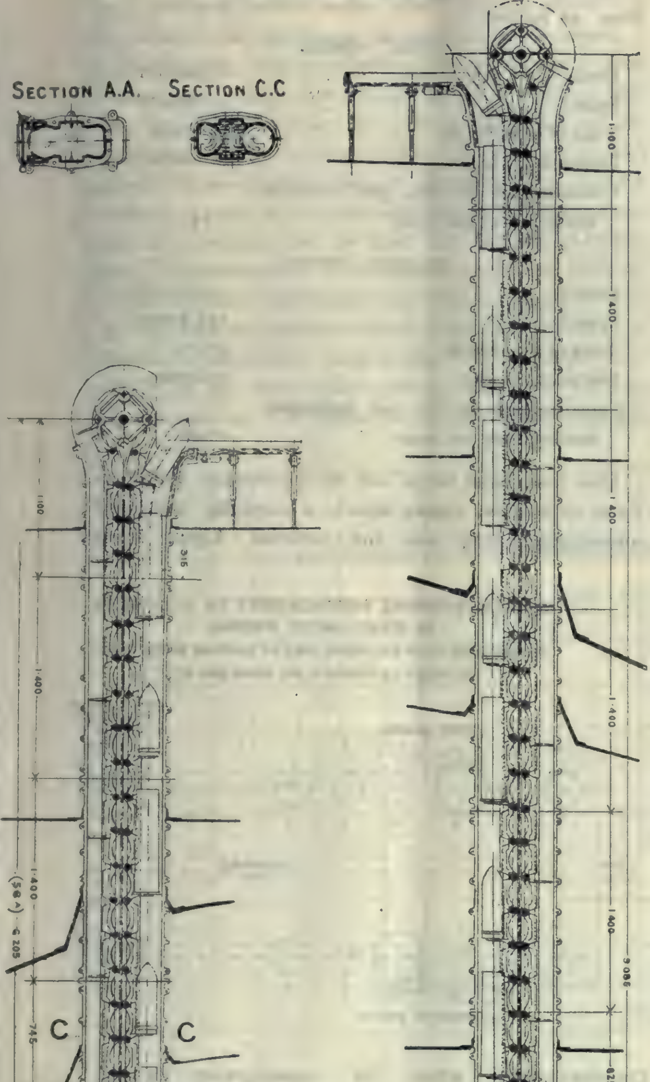
The results of the steam trials of both ships *Kasuga* and *Nisshin* are collected in the annexed table :—

Broadly speaking, the power developed by the engines in both ships compares well with that developed by the *Giuseppe Garibaldi's* engines.

The speed appears better in the Japanese cruisers, owing partly to the higher efficiency of the screw propellers, partly to the ship's bottom being perfectly clean, which was not the case with the *Garibaldi*, and finally to the speed observations on the *Kasuga* and *Nisshin* trials having been more accurate.

| Date of Trial. | Duration of Trial. | Draught. | | | Displacement in Metrical Tons. | Sea. | Wind. | Mean Air Pressure in Boiler-room. | Mean Steam Pressure in Boiler. | Mean Vacuum in Condensers. | Revolutions. | I.H.P. | | | Speed in Knots. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Forw | Aft. | Mean. | | | | | | | | Star. | Port. | Total. | |
| | Hrs. | Met. | Met. | Met. | STEAM TRIALS OF CRUISER "KASUGA." | | | | | | | | | | |
| 22 July, 1903 | 6 | 6·61 | 7·47 | 7·07 | 7,360 | Calm | Light | 6 | 165 | 27½″ | 93 | 5,210 | 4,964 | 10,174 | 18·46 |
| 29 Sept., 1903 | 1½ | 6·75 | 7·45 | 7·10 | 7,400 | Calm | Light | 29 | 165 | 26″ | 106 | 7,450 | 7,494 | 14,944 | 20·05 |
| | | | | | STEAM TRIALS OF CRUISER "NISSHIN." | | | | | | | | | | |
| 26 Oct., 1903 | 6 | 6·63 | 7 48 | 7·06 | 7,347 | Calm | Light | 9·5 | 165 | 28·2″ | 94·3 | 5,340 | 5,348 | 10,688 | 18·74 |
| 6 Nov., 1903 | 1½ | 6·76 | 7·47 | 7·11 | 7,413 | Calm | Light | 35 | 165 | 28″ | 106·5 | 7,439 | 7,457 | 14,896 | 20·15 |

STEAM TRIALS OF THE "KASUGA" AND "NISSHIN."



CHAIN ELEVATOR FOR THE 6-IN. AMMUNITION—"KASUGA" AND "NISSHIN."

# THE RUSSIAN VOLUNTEER FLEET.

The author (Mr. Herbert Rowell), remarks that the prominence into which the ships of the Russian Volunteer Fleet have been brought during the present war between Russia and Japan seems to make this a suitable time to bring the fleet, more especially the faster portion of it, into notice.

The Volunteer Fleet was originally founded as a material expression of the wish of the more wealthy Russians, especially those of Moscow, to assist their government, then at war with Turkey, by providing vessels which would be of use as transports and auxiliary cruisers, and be self-supporting as liners in time of peace.

The early career of the Volunteer Fleet as a trading organisation was not such as to encourage its founders, and there was considerable conflict of opinion as to whether it should be continued as a separate institution or transferred to the Russian Steam Navigation Company. The former course was decided on, and ten years after its foundation the whole organisation was transferred to the control of the Ministry of Marine, a definite policy of building inaugurated, and its constitution and objects clearly defined as being for the maintenance of a cargo, passenger, and postal service between Odessa and the East, and the general development of national commerce, all the operations of the fleet being on a commercial basis.

The vessels specially designed for this service may be divided into three classes; (1) Vessels for special service in the East; (2) Low-speed vessels for oversea service; (3) High-speed vessels for oversea service.

The third group, consists—in order of age—of the *Orel*, *Saratov*, *Petersburg* (now *Dnieper*), *Kherson* (now *Lena*), *Moskva* (now *Angara*), and the *Smolensk* (now *Rian*), and as it embraces the vessels which have in the highest degree those features which constitute the ideals sought after by those whose aim it was to develop the fleet to its highest degree of usefulness, it will be considered in greater detail.

### THE SMOLENSK.

The most recent of these vessels—the *Smolensk*—is 507 ft. over all, and 470 ft. between perpendiculars, by 58 ft. by 37 ft. depth moulded. She is fitted with twin-screw machinery, having cylinders 26 in., 44 in., and 75 in., by 48 in. stroke, four of each size, and 24 Belleville boilers with economisers, having a heating surface of 42,560 square feet. She has a hold capacity of 125,500 cubic feet, and a total cargo capacity of 266,800 cubic feet, and on 24 ft. draught she carries 5,000 tons deadweight, and has a speed of 20¼ knots. She carries 1,643 troops of all trades, and a crew of 174 all told.

The armament consists of 120 millimetres and 75 millimetres rapid-fire guns.

### METHOD OF OBTAINING MAXIMUM ECONOMY AT CRUISING SPEEDS.

The average speed on the voyage of the high-speed vessels is 11 to 13½ knots per hour, corresponding to 1,650 to 4,050 i.h.p., as against 9,000 to 16,500 i.h.p. which these vessels are capable of developing, and taking the powers corresponding to those speeds, the coal consumed works out at about 3 lb. per indicated horse-power per hour. These results reached a climax in the later boats fitted with Belleville boilers, on which a heavy loss was incurred on each voyage. Two attempts were made in two of the earlier vessels to increase economy at reduced speeds; in the first instance by fitting a fourth cylinder on the top of the high-pressure cylinder, and in the second by fitting an expansion valve in the high-pressure piston valve. Neither were considered to fully meet the requirements of the service, and it was therefore decided to fit in the *Smolensk* machinery of a type which was first worked out by the late Mr. F. T. Marshall (whose premature death occurred so recently) under the instructions and patents of Mr. Philip Watts and the late Mr. Magnus Sandison, and fitted with highly satisfactory results in a training ship named the *General Baquedano*, built at Elswick for the Chilian Navy, with a view of getting the maximum economy at cruising speeds. This arrangement, which formed the subject of a paper read before the Institution by Mr. Sandison, in April, 1900, consists (as will be seen by accompanying sketch) of six cylinders working on each shaft, two being high-pressure, two intermediate, and two low-pressure, in two sets but on six cranks, and so arranged that a set of three on either shaft may be disconnected and the connecting and slide valve rods slung clear, the whole crank shaft being driven by the set in operation. This system enables a voyage at half power to be made with the same consumption per indicated horse-power as for full power without the shaft alignment troubles experienced in the *Sardegna* and other vessels where the same end was sought to be attained by fitting two separate engines to each shaft with an arrangement for disconnecting the forward set.

The results obtained on the consumption trials were as follows:—

FULL SPEED.

| | |
|---|---|
| Power .. .. .. .. .. | 15,900 i.h.p. |
| Speed .. .. .. .. .. | 20¼ knots |
| Tons of coal burnt .. .. .. | 157 tons |
| Duration of trial .. .. .. | 12 hours |
| Consumption in lbs. per indicated horse-power per hour .. .. | 1·741 |

TRADING SPEED.

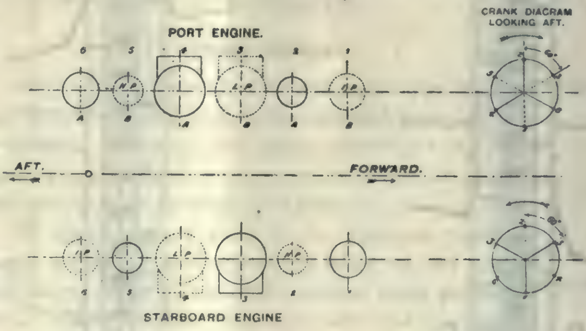
| | |
|---|---|
| Power .. .. .. .. .. | 4,055 i.h.p. |
| Speed .. .. .. .. .. | 13½ knots |
| Tons of coal burnt .. .. .. | 30·75 |
| Duration of trial .. .. .. | 10 hours |
| Consumption in lbs. per indicated horse-power per hour .. .. | 1·698 |

This result was borne out on the voyage from the Tyne to Odessa, during which a carefully measured consumption trial was run between Algiers and Constantinople, when the consumption for all purposes worked out at 1·73 lb. per indicated horse-power per hour, with a speed of 14¾ knots.

SKETCH SHOWING ARRANGEMENT OF CYLINDERS IN SIX-CYLINDER ENGINE.

DOTTED LINES SHOW CYLINDERS USED AT CRUISING SPEED TRIAL.

CYLINDERS LETTERED ALIKE FORM ONE SET



In practice it is advisable to use each set alternately for the voyage out and home.

### A COMPARISON.

It is possible to make the change from half to full power at sea with comparatively small loss of distance covered. The accompanying diagram serves to show the distance in miles covered by two vessels, one "B" fitted with the *Smolensk* type of machinery, and the other "A" with the ordinary type of machinery, during the first twelve hours of a voyage, assuming that both started at a cruising or trading speed of 14 knots with one boiler-room out of three under steam, and received orders at the end of the third hour to proceed at full speed.

In making this comparison it is assumed that water-tube boilers are fitted in both vessels, and that the time necessary for getting up steam on the unlighted boilers is three hours. If the vessels had equally started with steam on all boilers the distance steamed at the end of twelve hours would have been the same, seeing that in that case the six cylinders would obviously have been coupled up before starting. If both vessels had cylindrical boilers the difference at the end of twelve hours would be 58 knots as shown by the dotted lines, seeing that although there would be the same falling off in speed in "A" as in the case of "B" during the four hours engaged in coupling up, the time taken to get up steam would be longer. It will be seen that the vessel "B" at the end of seven hours' steaming has lost 68 knots, and against this she has, apart from saving in the cost of fuel, a radius of action, at the cruising speed of 13 knots, of 4,700 knots per 1,000 tons of coal, as against a radius of action of 3,150 knots per 1,000 tons with the ordinary type of machinery. This represents, allowing for carrying coal in No. 3 hold a radius of action of 12,600 knots as against 8,500. With coaling stations at definite points she would either have the advantage of carrying considerably more deadweight or of steaming at a higher speed owing to the saving in weight of bunkers.

(*To be continued.*)

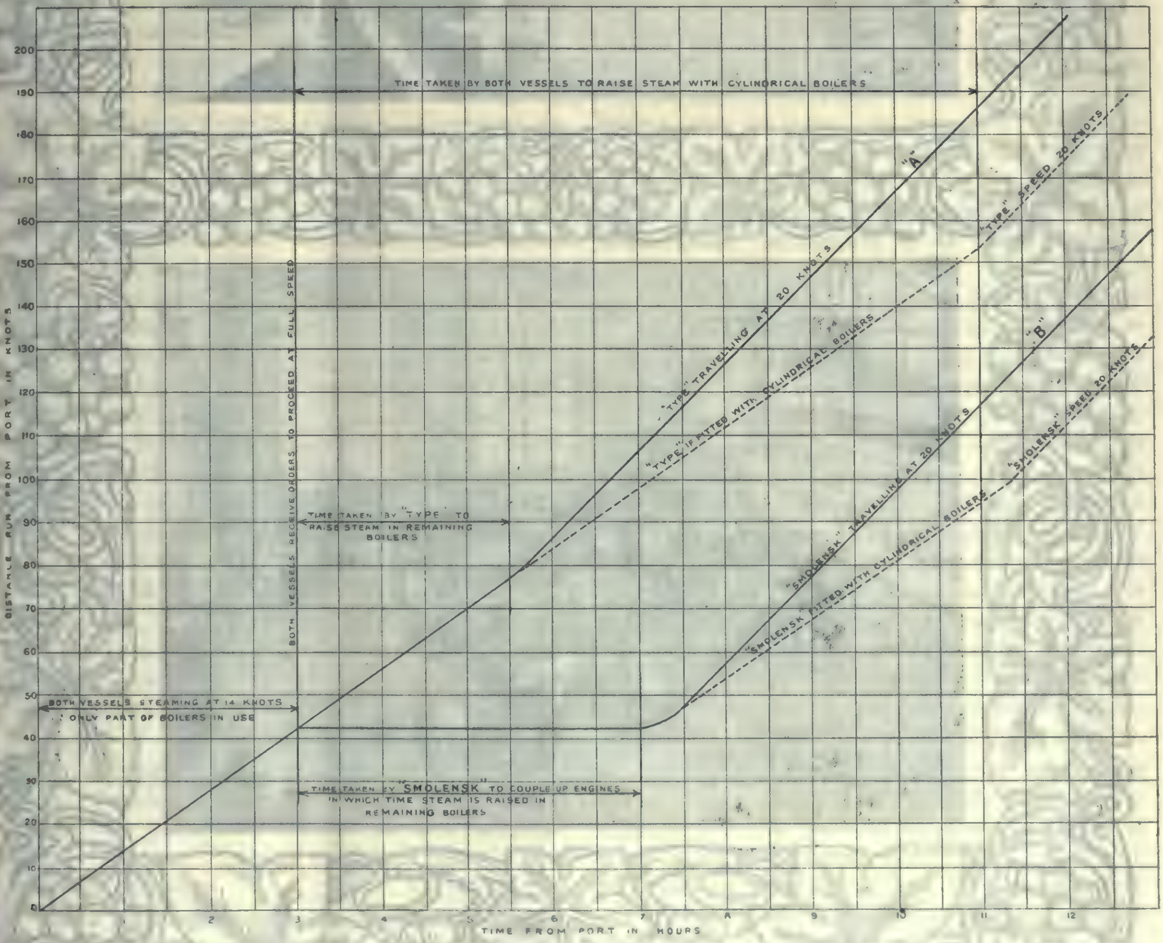
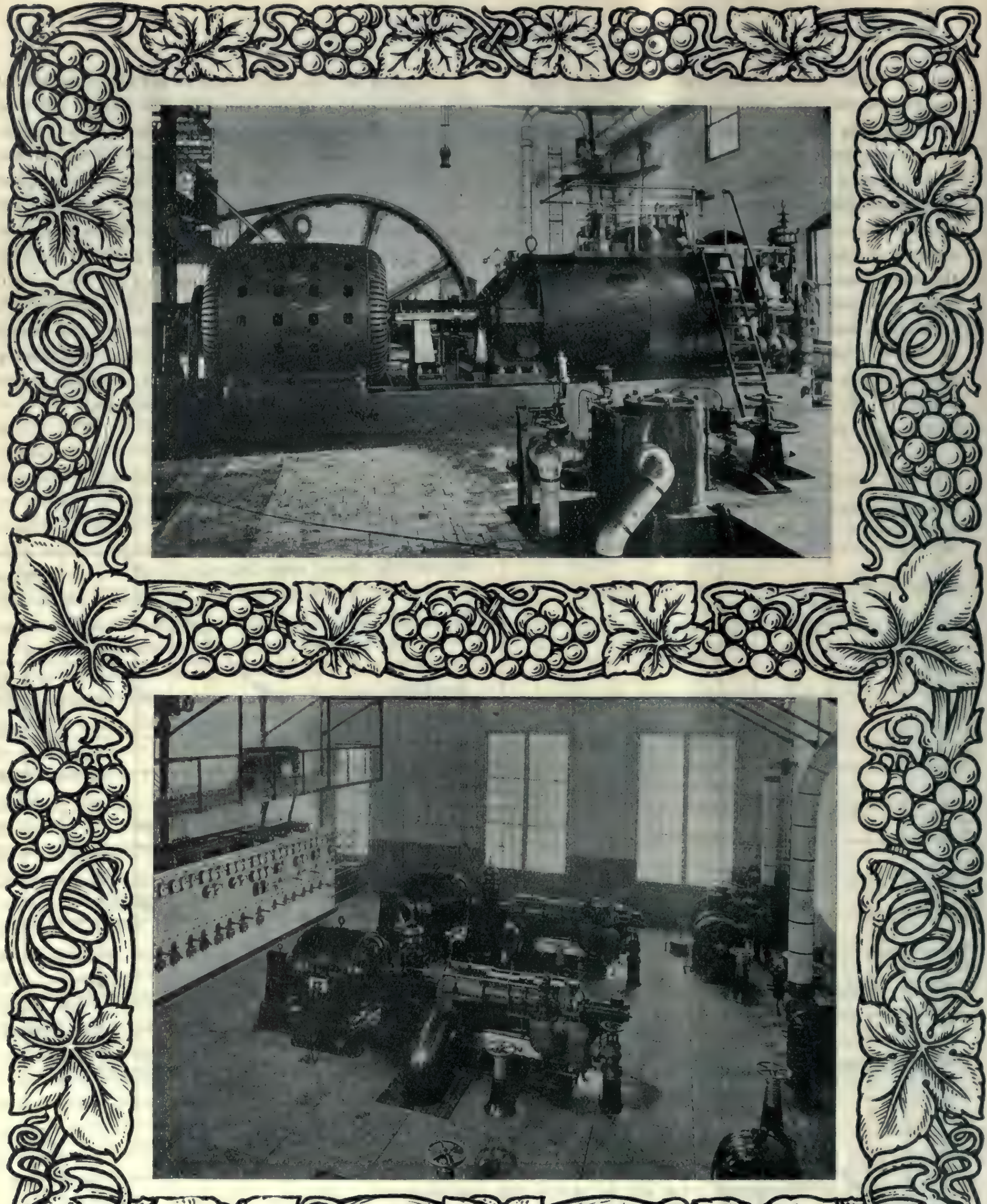


DIAGRAM SHOWING RELATIVE POSITIONS UNDER SIMILAR CONDITIONS OF "SMOLENSK," AS BUILT AND IF FITTED WITH THREE CYLINDER ENGINES, DIFFERENCE BEING DUE TO TYPE OF ENGINES. DOTTED LINES SHOW DIFFERENCE IF BOTH VESSELS HAD CYLINDRICAL BOILERS.



RECENT TURBINE INSTALLATIONS.—VII. AND VIII.

1,000-h.p. Westinghouse-Parsons Steam Turbine Generating Unit in Power House of the Springfield Electric Light Company, Springfield, Mass.

Citizens' Light, Heat and Power Company, Johnstown, Pa. Two 600-h.p. Westinghouse-Parsons Steam Turbine Generating Units.

# ELECTRIC UNITS.

AT a meeting of the Institution of Electrical Engineers on April 6th there was a discussion on the report to Council on the International Electrical Congress at St. Louis by Mr. W. Duddell, the honorary secretary to the Delegation to the Congress, and on papers on "Systems of Electric Units" by Professor Ascoli, Professor G. Giorgi, Professors H. S. Carhart and G. W. Paterson and Dr. F. A. Wolff.

Mr. Duddell in opening the discussion said that the Institution had been represented and took a very active part in the last International Electrical Congress at St. Louis. His object in opening the discussion was to focus the attention of members on some of the main points in connection with standards and magnetic units raised at St. Louis, and so to prevent the discussion from extending over too wide a range of topics. One of the first points which came up for consideration was as to the true value of the volt and ampere. It was generally admitted that the true value of the volt was such that the E.M.F. of the Clark cell at 15 deg. C. was much nearer 1·433 volt than 1·434 volt, the present legal value. As the volt, ampere and ohm were connected by Ohm's law, if standards were fixed for any two the third would be determined in terms of them. If a standard for the volt were adopted it would probably be in the form of a cell, and it was a question if the Clark or the Weston cell were the more suitable. Then there came this question: Should the legally defined fundamental units be the C.G.S. units or those obtained by assigning values to the concrete standards? All were agreed that the first fundamental standard should be the C.G.S.; the second, a concrete representation of the fundamental standard, and the third a practical standard to be used in everyday work. On the vexed question of names it would appear that names were required for three magnetic units; magnetic potential, magnetic flux, and magnetic reluctance.

### LORD RAYLEIGH PREACHES CONSERVATISM.

Lord Rayleigh said that Mr. Duddell had put the questions before the meeting in a succinct form. An important point was as to the alternative of volt or ampere as the second principal standard. He noted that in the discussion held on the other side, as given in the report, it seemed to be taken for granted that there was no residual uncertainty in connection with the ohm. If the ohm had come to us from heaven, no doubt a good deal might be said in favour of having the volt for a standard; but he would point out that in that case there would be added to the uncertainty about the ohm, the uncertainty about the volt; whereas if the ampere were adopted as the second primary standard, any error attaching to the ohm would have nothing to do with it. That was a point which should be borne in mind in dealing with the question of a second standard. He did not dispute that the ohm had been determined more accurately than the ampere or the volt, but in these matters it was well to look ahead, and it might be that the researches in progress would in the near future enable the ampere to be more definitely determined. On the subject of the Clark and Weston cells, he could not speak positively because he had no experience of his own to guide him in relation to the Weston cell. The uncertainty in the case of the Clark cell related principally to the mercury end of it, and in that respect there was no difference between the Clark and the Weston. He understood, however, that this uncertainty was in a fair way towards removal, and then attention might be concentrated on the advantage the Weston cell possessed at the other end in respect of the smaller temperature co-efficient. Those who had used the Weston cell spoke positively as to the practical advantage it possessed in that respect. In these matters, however, it was well not to be in too great a hurry, and the shorter time over which the experience with the Weston cell extended was a point which should not be overlooked when it was suggested it should replace the older Clark cell. Referring to magnetic units he preferred to leave the matter in other hands. He rather objected to the epithet of "irrational" which had been used in connection with the old system, although in the abstract probably the new system would be the more convenient. He hoped that names would not be multiplied unduly, and there certainly was a tendency in that direction in some of the proposals put forward. Another question related to the kind of names, and he would confess he had been rather horrified at some of the suggestions which had been made.

### PROFESSOR AYRTON TO DETERMINE THE AMPERE.

Professor W. E. Ayrton: The point was whether the ampere should be defined in terms of the electrochemical equivalent of silver or of the ohm and the electro-motive force of some standard cell; and as Lord Rayleigh has pointed out the most important point has been entirely omitted, practically no reference being made in the discussion which took place at St. Louis as to whether the ohm was known to a very high degree of accuracy or not. For that reason he had had compiled a table showing past determinations of the ohm made in this country. Lord Rayleigh had made it 106·27 c.m. Dr. Glazebrook by a totally different method 106·28 c.m. Other determinations were 106·22 106·30 106·32, and the last, a determination made in 1897 with the Lorenz apparatus designed for use at the McGill University gave 106·27. There was a good deal of difference between these determinations, as will be noted, but the mean was 106·28. He could not find any more recent determination of the ohm.

Professor Carhart's experiments in connection with the Clark cell did not permit him to say more than that the legalised value of the E.M.F. of the Clark cell was too high. That, then, was the result arrived at by the experiments which advocate the definition of the ampere in terms of the ohm and the E.M.F. of a cell. It was true that the Board of Trade could state the resistance of a coil within one-hundredth part of one per cent., but that did not mean that the ohm was known to that degree of accuracy, but merely that at the Board of Trade they were able to compare the resistance of wires sent to them with the resistance of a standard wire in the Board of Trade to that degree of accuracy. The ideal ohm was not known to anything like that degree, and in dealing with this question of standards he thought the ohm might be put on one side. It was possible in a year or two the ohm might be known to a much higher degree of accuracy. With regard to the volt, that could not easily be determined absolutely. You could, however, make a direct determinaton of the ampere with a high degree of accuracy. It had puzzled him to note that while within the last thirty years there had been a good many attempts to determine the ohm, nobody had redetermined the ampere. By the aid of a new apparatus which had been constructed he hoped to determine the ampere certainly within one part in 10,000, and perhaps to within one part in 20,000; and if that were done the value of the ampere would have been more accurately determined than any other electrical unit.

### THE CLARK CELL OUT OF DATE.

Mr. A. P. Trotter said that he wished to make it clear that his remarks were not intended to represent the official views of the Board of Trade. The only part of the work of the Committee of 1890 which needed revision, was the definition by the Clark cell, and the specification of that cell. "The Board of Trade Volt Standard" had nothing to do with the Clark cell, and was not verified with reference to that cell. Without going outside the Board of Trade Electrical Standards Laboratory, a discrepancy had been discovered between the declared value of the Clark cell, and its observed value. He had taken steps to let it be known, semi-officially, that this value appeared to be 1·4329 instead of 1·434 at 15 deg. C., or 1·434 at 14 deg. C. He was not convinced that this discrepancy of 0·788 in 1,000 was of appreciable importance "for use in trade." It was on the limits of practical importance in connection with lamp-testing, for it was equivalent to nearly 0·4 of one per cent. of candle-power. The specification of the Clark cell appended to the Order in Council, was now out of date, and he could not recommend that form of cell for work of the highest accuracy. Large cells, as suggested by Professor Schuster were better, and it was probable that a cadmium cell was better still. Knowing the liability of Clark cells to dry up, he should prefer a saturated cell with a higher temperature co-efficient to a semi-saturated cell with an almost negligible temperature correction for high class laboratory purposes. Experience of the last fifteen years has shown that neither the Clark cell nor any improvement of it was necessary in a Standards Laboratory as a standard, while, on the other hand, such cells were very valuable pieces of apparatus, both for scientific and for trade purposes. The question of amending the legislation of this and of other countries has been discussed. He was not prepared to recommend the Board of Trade that any amendment of the Order in Council was necessary. But, if an amendment were to be made, he should recommend that the definition of the volt should not contain reference to the Clark or to any other standard cell, but that England should fall into line with Germany, Austria, Belgium, and Switzerland. He attached little importance to the Volt Standard as a legal standard. It was a useful laboratory instrument. The discussion was adjourned until April 13th.

# ELECTRICAL EQUIPMENT IN CONTINENTAL STEEL WORKS.

A VERY instructive account of the latest methods employed in steel works on the Continent has just been issued by the Electrical Company, Ltd. The descriptions, of course, only refer to some of the installations which they or their parent companies have put down, but as none of the plants are identical and every application of electric driving has been considered on its own merits, they at once reflect the most modern continental practice and suggest the wider application of electric power in steel works at home. The questions chiefly considered are generating plant, electric equipments for ore-handling plant, etc., and electric power in rolling mills. In the latter department, of course, the rolls require as much horse-power as all the rest of the plant put together.

In cases where the works have their own generating plant, absolute constant voltage at the switchboard is not in most cases of very great importance, but in order to smooth over the current peaks, with consequent drop in voltage throughout the whole system, which cannot be avoided under ordinary circumstances where such large motors are employed,

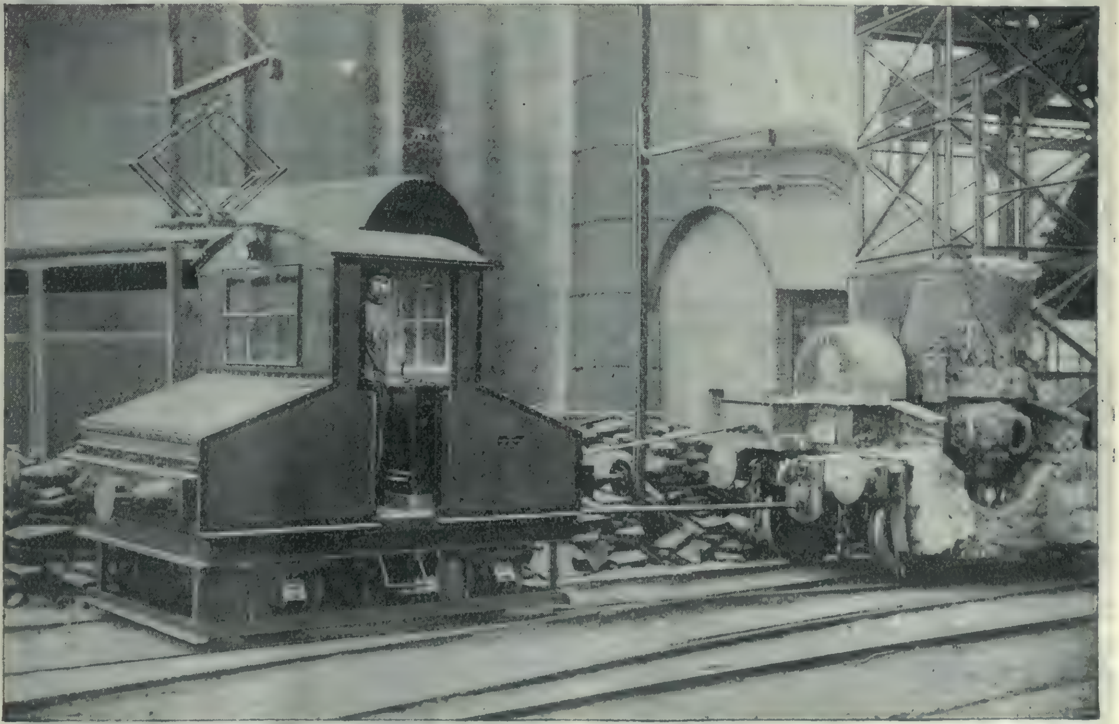


FIG. I. FOUNDRY LOCOMOTIVE AT THE SOCIETE DES ACIERIES DE LONGWY, MOUNT ST. MARTIN, FRANCE.

Two continuous current motors are fitted, one of 12-h.p. for travelling, and the other of 3-h.p. for tipping the ladle, the connection being made by knuckle-joint. Double trolley wires are employed, the voltage being 220. Speed, 2½ miles per hour; gauge of track, 4 ft. 8½ in.

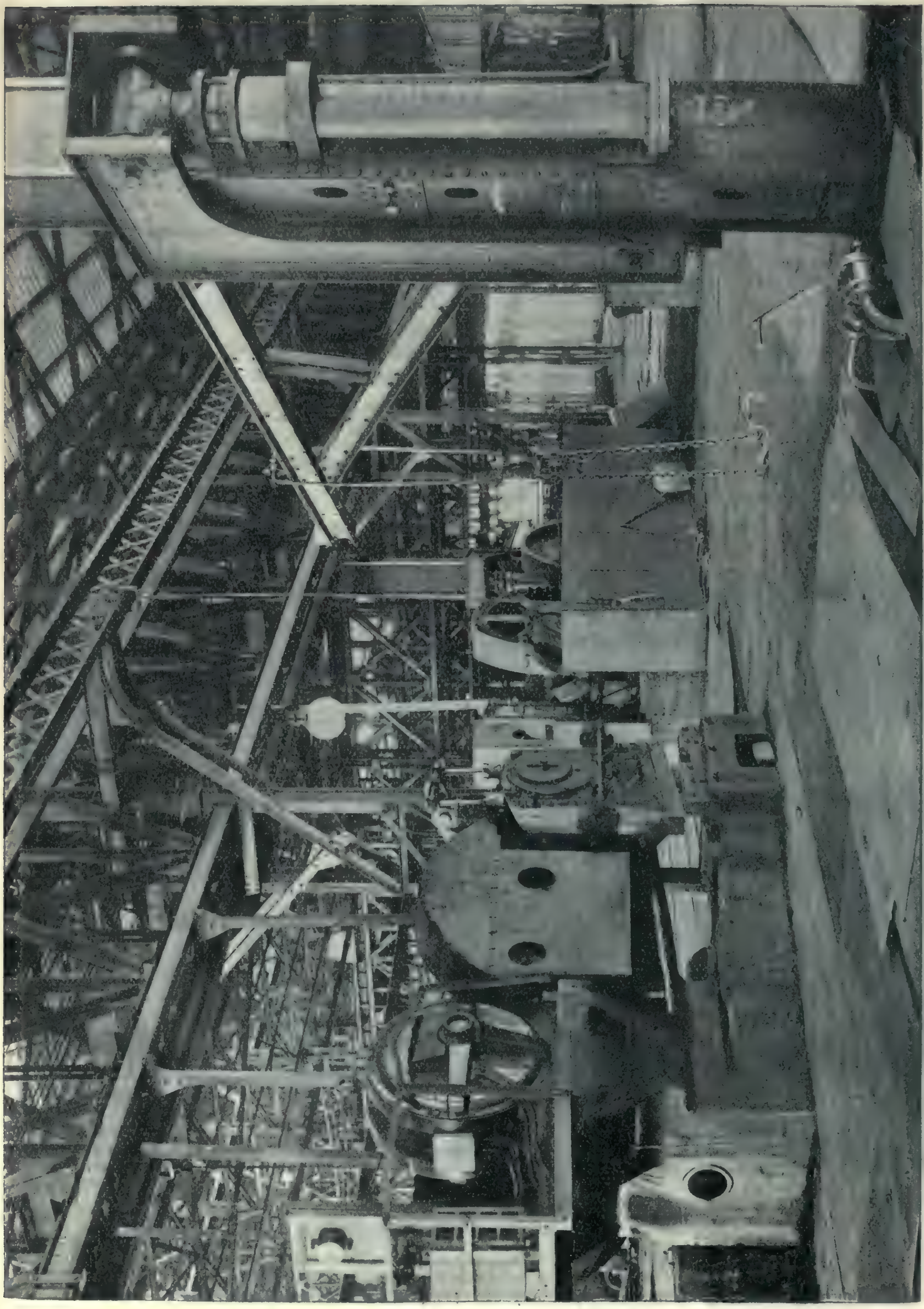


FIG. 3. HEAVY SHEARS AT THE A.-G. GUTEHOFFNUNGSHUETTE, OBERHAUSEN.

90-h.p. 3-phase motor, 190 volts, 720 revolutions per minute. Shears by the Duisburger Maschinenbau A.-G.

with the necessity of developing suddenly very large overloads, as for instance when a bar first enters the rolls, the firm have perfected a method to obviate any trouble that might be experienced from this cause. The system consists essentially in mounting a heavy flywheel on the motor shaft, which is caused automatically to give up its inertia when an overload occurs. To allow the flywheel to do this, the motor, in the case of a direct-current system, is provided with a distinct field winding, which allows the armature to drop in speed when the current consumption has reached a certain pre-determined value. By choosing suitable reasonable proportions for the flywheel and field-winding, it is possible to keep the overloads on the motor within very reasonable limits, so that no detrimental disturbing effects are reproduced in any other electrical apparatus that may be supplied with current from the same generators.

In a three-phase system the same arrangement of flywheel is adopted, but a resistance is automatically thrown into the motor circuit on an overload, which increases the slip with consequent lowering of the speed, and allows the flywheel to supply the extra energy required. The best size of flywheel to suit each case can be calculated beforehand, but the best amount of slip to allow for the motor can only be arrived at by actual tests under working conditions, and provision is therefore made for finally adjusting this on site.

When the rolls have to be frequently reversed, or the current is obtained from a public supply company, it is necessary to employ an "Ilgner" plant. In this system a motor generator is employed, consisting of a motor which is run directly off the supply mains, driving a very heavy flywheel of cast steel at a high speed, and also a special direct current dynamo known as the starting machine,

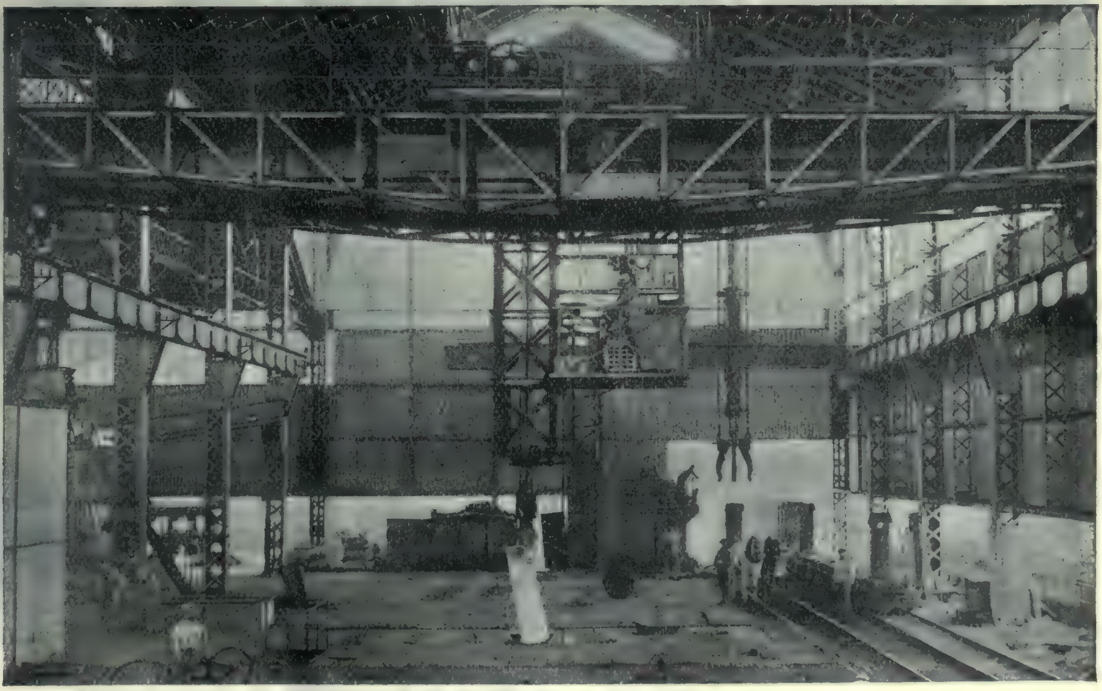


FIG. 2. THREE-MOTOR TRAVELLER AT THE WORKS OF THE SOCIETE ANONYME DE VEZIN-AULNOYE IN HOMECOURT-JOEUF.

3-phase 500-volt motors, 40-h.p., for lifting, 11-h.p. for cross traversing, and 30-h.p. for longitudinal traverse. Mechanical portion by A. Delattre and Co., Ferrière la Grande, France.

which supplies the current for the main driving motor coupled to the rolling train. The shafts of the motor, flywheel and starting dynamo are all directly coupled together, and always run in the same direction. The motor of the motor generator is arranged on the same principle as described above for allowing the speed to drop on an overload. The starting dynamo and the main driving motor are separately excited by means of a small machine directly mounted on the extension of the motor generator shaft. The regulation is entirely carried out by manipulating the field of the starting dynamo, which, when reversed, causes the main driving motor to change its direction of rotation. This system has the advantage that the speed of the main driving motor is independent of the load for a definite position of the shunt controller, and therefore is particularly useful and economical where it is desired to drive the rolls at several different definite speeds, as the losses are very small, due to the regulation being entirely effected by altering excitation of the starting dynamo.

The part which electricity can play in the efficient handling of heavy weights in iron and steel works is demonstrated by three-phase electric travellers, electrically driven longitudinal live rolls for removing the finished material after passing through the mills, and many other appliances, including large rams for coke ovens driven by a 46 h.p. three-phase motor, and mounted on portable trucks, electric charging machines for Siemens-Martin furnaces, and 30-ton

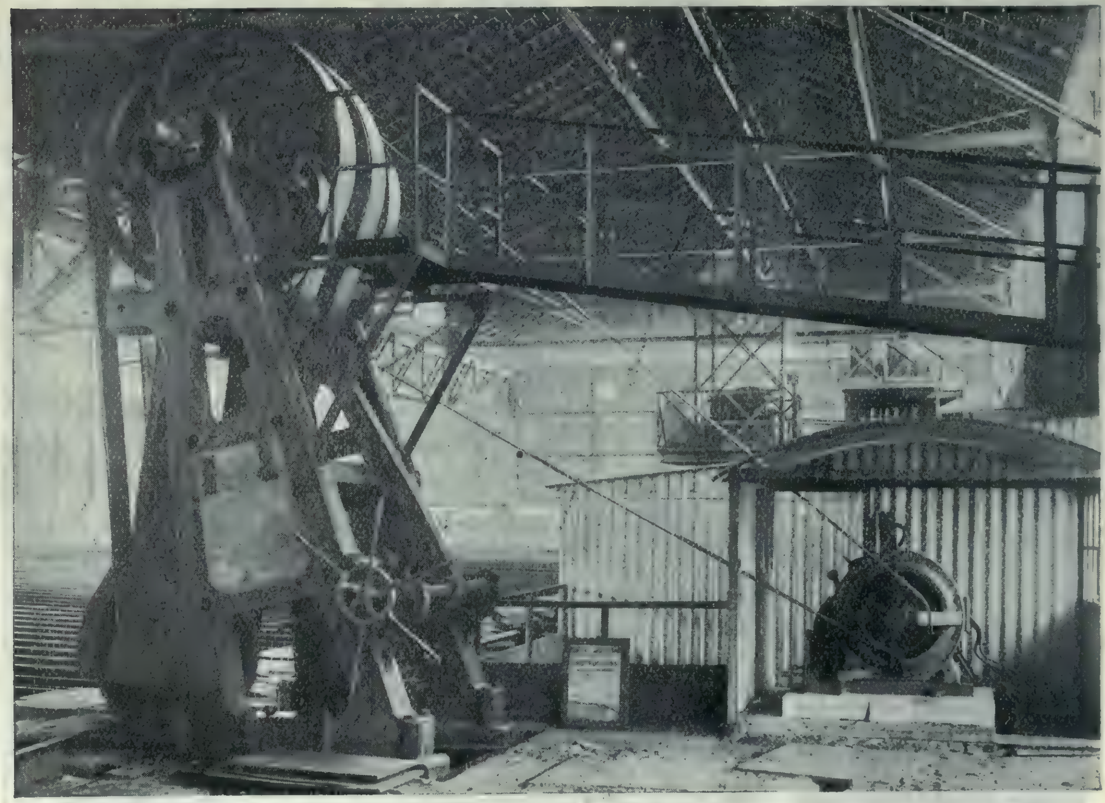


FIG. 4. PENDULUM SAW AT THE WORKS OF THE SOCIETE ANONYME DE VEZIN-AULNOYE IN HOMECOURT-JOEUF.

35-h.p. 3-phase motor, 500 volts, 720 revolutions per minute. Saw by A. Delattre and Co., Ferrière la Grande, France.

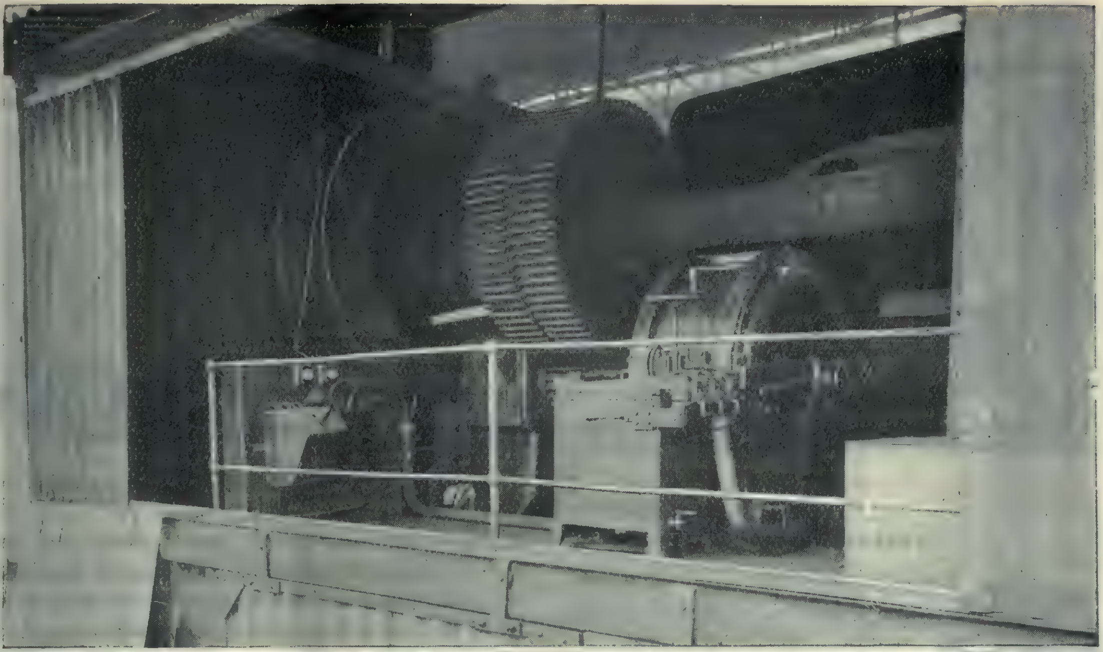


FIG. 5. ROUGH SHEARS AT MESSRS. BORSIG'S WORKS BERG AND HUETTENVERWALTUNG O.-S.
75-h.p. 3-phase motor, 330 volts, 550 revolutions per minute. Shears by Otto Froriep, Rheydt.

travellers, driven by three-phase motors, used for handling large ladles of molten metal in connection with the Bessemer process, and for pouring it into moulds. In fig. 1 is shown another method of handling large ladles of molten metal, the ladle being mounted on a separate steel truck, which is hauled from place to place by an electric locomotive. The latter is also provided with a second motor for operating the ladle-tipping mechanism, and the connection between them is effected by a detachable telescopic shaft fitted with knuckle joint. This arrangement has the additional advantage that the locomotive can be used for shunting operations, etc., when not employed on this work.

Electric locomotives for general shunting operations are much employed in works on the Continent, and as overhead trolley wires would be in the way, they are often provided with accumulators which can be charged at any time when the locomotive is not in use without removing them from the truck.

Fig. 2 shows a large bank of furnaces served by a three-phase motor traveller.

In figs. 3, 5 and 6 (page 780) are shown electrically-driven heavy plate shears, the motors being direct-coupled to the shears by gearing. For this class of work three-phase motors are more suitable, as they have larger overload capacities, with quicker acceleration, than those of the shunt-wound continuous current type. Fig. 4 shows a large pendulum-saw for cutting hot material. As the peripheral speed has to be so high these are generally belt-driven.

## RAND OUTPUT.

The London secretary of the Transvaal Chamber of Mines is advised by cable from Johannesburg that the total gold output of the mines of the Transvaal for March, 1905, amounted to 385,575 oz. for the Witwatersrand district, and 14,248 oz. for the outside districts, in all 399,823 oz. of fine gold, total value £1,698,340, an increase of 36,012 oz. in weight, and £152,969 in value, as compared with February, 1905.

# NAVAL NOTES.

### GREAT BRITAIN.

THE accident to the destroyer *Spiteful* last week is noteworthy as showing that the frailty of this class of vessel, besides being a source of danger is also, on occasion, a safeguard. The destroyer, while steaming at about 20 knots, ran into, and practically passed over, a barge laden with bags of cement, which has been compared, not inaptly, to a stone wall. The bows of the destroyer were stove in, but her light build considerably minimised the force of the shock, she gave, as it were, to the impact, and she was kept afloat until placed in dry dock, where she will probably be for some time to come.

The sale of old warships at Chatham was very similar to all previous dispersals of a similar nature, and nothing startling in the way of prices was raised. The old *Monarch* fetched £14,550, the *Warspite* £18,150; the *Northampton*, £15,800; and the *Australia*, £10,900. All these vessels were disposed of to English firms, and were sold under condition that they shall be broken up within a year. It has been suggested that before these old vessels were sold by public auction we might have offered them to Japan. But Japan is able to pick up all the scrap iron she requires in the neighbourhood of the Sea of Japan, and to suggest that any of them could have been of value as vessels of war is absurd. Such money as she invests in warships in the future, Japan will spend in having new and up-to-date ships; second-hand bargains can be of little service to her.

The reports of the comparative steam trials between the *Amethyst* and *Sapphire* will be awaited with interest. These two vessels are practically identical in build and horse power, but the former is fitted with turbines, the latter with reciprocating machinery, and the objects of the trials are to discover the relative rates of gathering way, the vessels lying abeam of each other at the start; the capabilities of each class of machinery in transferrring from a speed of 15 knots to full speed astern, and from 10 knots to full speed astern.

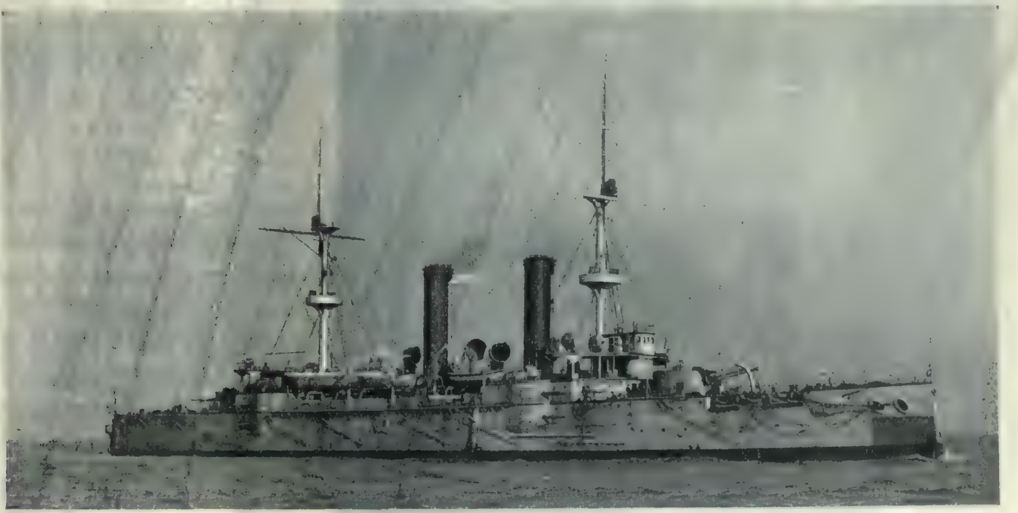
### RUSSIA.

A paper was recently read before a Russian technical society on the types of battleships and cruisers most suitable for the Russian Navy, and an interesting summary of the paper appeared in the Times, from which I quote the following passages: Unlike many specialists of the day, Mr. Beklemishev holds that the displacement should be moderate, about 10,000 tons, a conclusion, however, as ensuring a handier type, which he again bases entirely on the inadequate experience in seamanship, which he regards as an ineradicable defect of the Russian sailor. It must not be forgotten, he says, that the Russian fleet owes whatever success it has had to its artillery and not to manœuvring. High speed, requiring huge engines and their skilful tending, also presents great difficulties. A not too high limit of speed must accordingly be selected, allowing the battleship to be manœuvred in safety by Russian sailors. In regard to seaworthiness and steaming radius, it should be borne in mind that Russia's ironclad fleet will not have to operate in the open oceans, but in comparatively shallow waters, hampered by shores and banks. On the other hand, the power of the guns must be developed to the highest pitch attainable. The side armour must extend to at least 10 ft. below the waterline, in order to protect the ship from projectiles striking the water at a high angle. The author then proceeded to discuss the question of cruiser, coming to the conclusion that the best type for squadron fighting is that of the *Bayan*.

Acknowledging that the classes of vessels so far considered are not suitable for operations in the open ocean, Mr. Beklemishev then gives his opinion on what type of ships Russia should build for this purpose, evidently having in view the capture or destruction of the enemy's merchant fleet. He recommends the so-called "autonomous" cruisers, the type of which was worked out by the late Mr. Kazi. Such cruisers must possess a speed of not less than 21 knots, very effective armour protection, first-class artillery, and, accordingly, great displacement (up to 20,000 tons). They must be accompanied by a numerous flotilla of second-class torpedo-boats to be carried on deck. In the discussion which followed, we are told that the President said that the home resources of Russia for shipbuilding were considerable, but that the ships were inadequate. If the Imperial Admiralty would guarantee Russian yards orders for ten years, the owners would undertake to make good the deficiency in ships.

## WAGES IN THE IRON AND STEEL INDUSTRY.

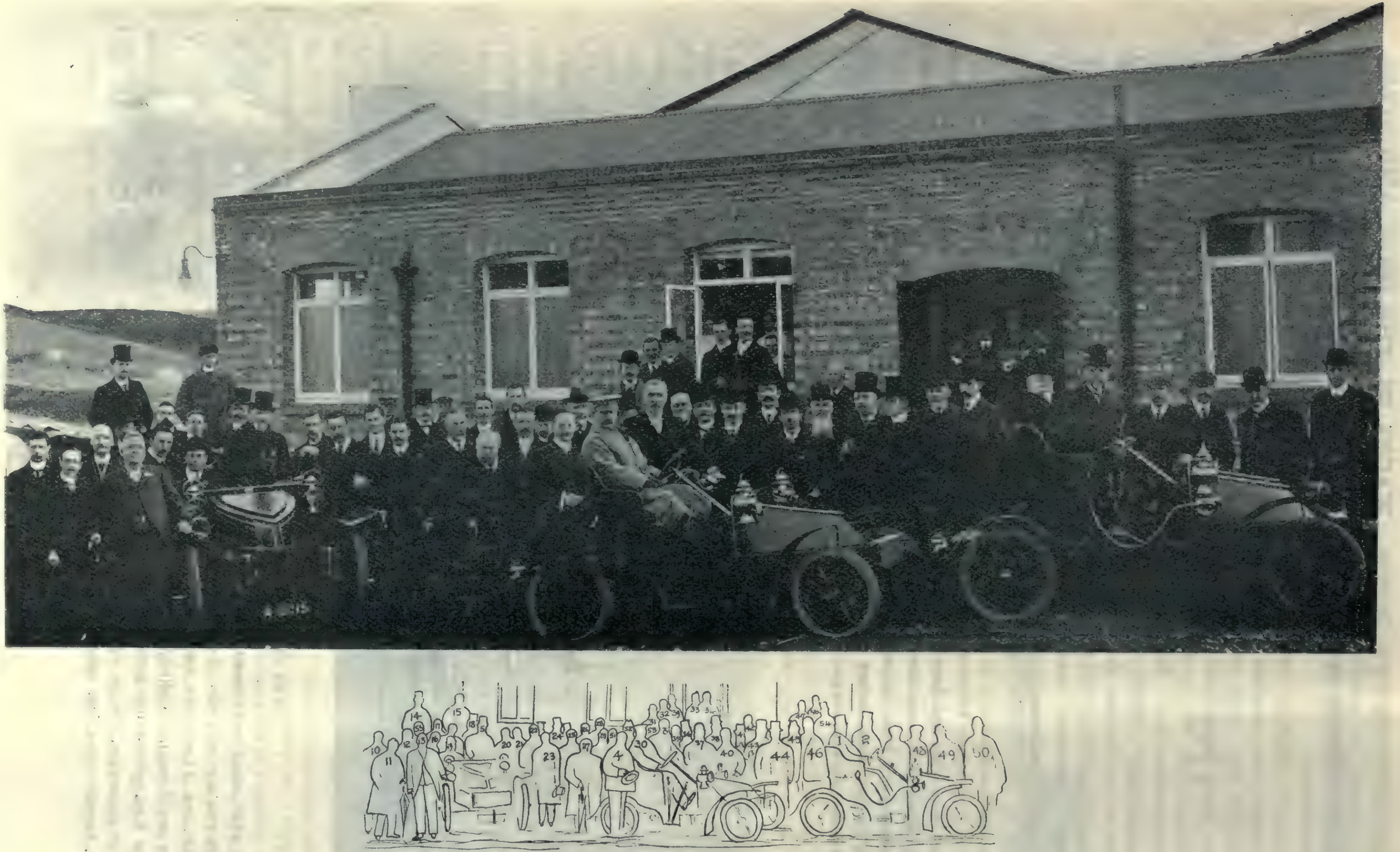
Sir Benjamin Hingley presided recently at the annual meeting of the Midland Iron and Steel Wages Board which was held in Birmingham. The report stated that from December, 1903, to February, 1904, the rate for puddling was 8s. 9d. per ton, but since then it had been reduced to 8s. 6d. In September last the operatives gave three months' notice to terminate the sliding scale agreement. A canvass of the trade had been made with the result that it was felt that there was sufficient ground to justify the recommendation that the board be continued and new rules with this object in view were now adopted. The balance-sheet showed that the receipts for the year had been £951 15s. 11d., including £447 15s. 8d. employers' contributions, and £339 15s. 9d. from operatives. The expenditure had been £865 14s. 1d., and there was a balance in hand of £86 1s. 10d. In moving the adoption of the report Sir Benjamin Hingley said that they had passed through a very trying time, but with mutual forbearance their difficulties had been overcome.



THE JAPANESE ARMOURED CRUISER "ASAMA."

Built at Elswick, 1898; steel, two screws; two funnels, fore and aft; two barbettes, with gun houses; two military masts, with one top on each. Length, 408 ft.; beam, 67 ft.; mean draught, 24 ft. 8 in. Displacement, 9,750 tons; I.H.P. nat. 13,000=20 knots; forced draught, 18,000=21½ knots. Engines: four-cyl. 3 expan., by Humphrys and Tennant. Cylindrical boilers, stoked from wings.

Armament: Four 8-in. quick-firing guns, in pairs, on twin mountings in the barbettes; fourteen 6-in. quick-firing guns, ten in casements, four on upper deck; twelve 12-pounder quick firing; seven 2½-pounder quick firing; five 18 in. torpedo tubes, four submerged and cut in bow behind 6-in. armour.



THE OPENING OF NEW WORKS BY THE VAUXHALL IRONWORKS COMPANY, LTD. A GROUP OF THE GUESTS.

In our issue of March 31st, we described the opening of the new works of the Vauxhall Ironworks Company, Ltd., at Luton. We have since received the above photo taken on this interesting occasion, the guests being as follows:—

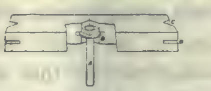
1, The Mayor of Luton, Mr. G. Ordish; 2, Ald. G. Warren; 3 and 4, Messrs. William Gardiner and A. E. Ash, Directors of the Vauxhall Ironworks Company, Ltd.; 5, Mr. G. Sell, Town Clerk of Luton; Messrs. 10, — MacFarlane; 11, J. Shoolbred; 12, D. Tudge; 13, G. A. Damiral; 14, S. W. Couper; 15, R. Selz, Director; 16, C. N. Ash; 17, Alex. Richardson, "Engineering"; 18,—Richardson, "Engineer"; 19, R. Salem; 20, P. Denny, Dumbarton; 21, T. Langridge; 22, J. Ashhurst; 23 R. Hitchcock; 24, A. T. Tebbitt; 25, J. Ferguson; 26, C. P. Woods; 27, T. H. Wilson; 28, S. Williams, Postmaster; 29, T. R. Blackie, Lloyd's; 30, R. W. Wright; 31, W. N. Hamshaw; 32, P. C. Kidner, Director; 33, F. C. Baisley; 34, J. J. Fifield, Secretary; 35 — Strother-Wright; 36, J. Clark, British Indian Steam Navigation Company; 37, T. G. Sharp, "Motor"; 38, J. H. Humphryes, Messrs. Edward Wood and Co.; 39, F. W. Hodges, Director; 40, Representative of the "Westminster Gazette"; 41, S. Green, Station Master; 42, J. Salisbury; 43, E. W. Clayton, Midland Railway; 44, Davidge Page, Ed. "Page's Weekly"; 45, Representative of the "Morning Post"; 46, A. Petch, West Hydraulic Engineering Company; 47, C. Manning; 48, B. E. Todhunter, West Hydraulic Engineering Company; 49, H. J. Swindley, "Autocar"; 50, S. F. L. Fox, District Surveyor; 52, R. Gardner; 54, — Haucke; 55, R. Halsey; 56, H. Goodman.

# THE STETTER AUTOMATIC TRIMMING PRESS.

THIS machine, built by the Waterbury Farrel Foundry and Machine Company, of Waterbury, Conn., U.S.A., and illustrated herewith, is designed for the economical trimming of the flash from the under side of bolts which have been headed hot by the one-stroke direct process.

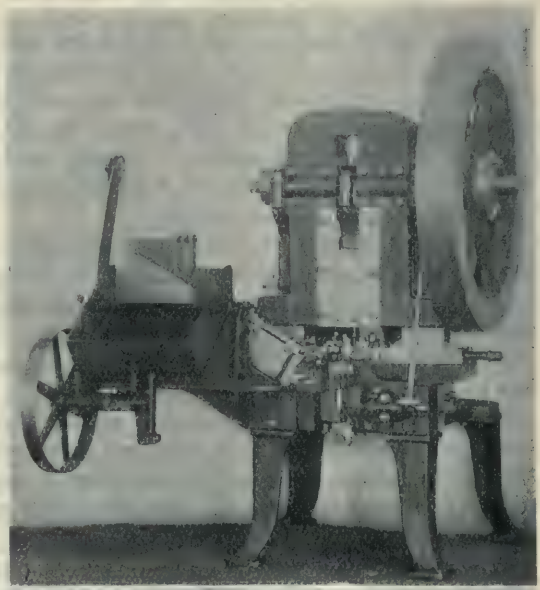
The larger size machine will trim bolts up to 1 in. diameter of shank at the rate of 22,000 per day of ten hours. The smaller machine, built for bolts up to ½ in. diameter, is even more rapid. The speeds of this class of machinery, however, usually vary, and are dependent more or less upon the skill of the operator. One of its features is, that since the bolts are trimmed with the shank down, no burr is left underneath the head. It is not necessary, therefore, to tumble the bolts after they are trimmed. The ½-in. machine is provided with an automatic hopper feed.

FIG. 3.—Die with blank ready for trimming.



The general operation of the machine is as follows: The bolts are fed by the operator into the conductor or hopper shown on the left in the illustrations. They are taken by gravity in front of the rocking carrier, which transfers a single bolt to the slide, which in turn passes it to the dies. The dies are of the open type, separating to allow a bolt to be carried between them, and closing again before the bolt is trimmed. The carriers and slide closers are provided with safety devices, which prevent any serious damage to the machine in case a bolt gets misplaced. The trimmed bolts drop into a receptacle under the machine.

The flywheel of the larger machine is 42 in. in diameter, 5½ in. face, weighing 600 lb. The dies are 4 in. by 5 in. by 1¾ in. thick.



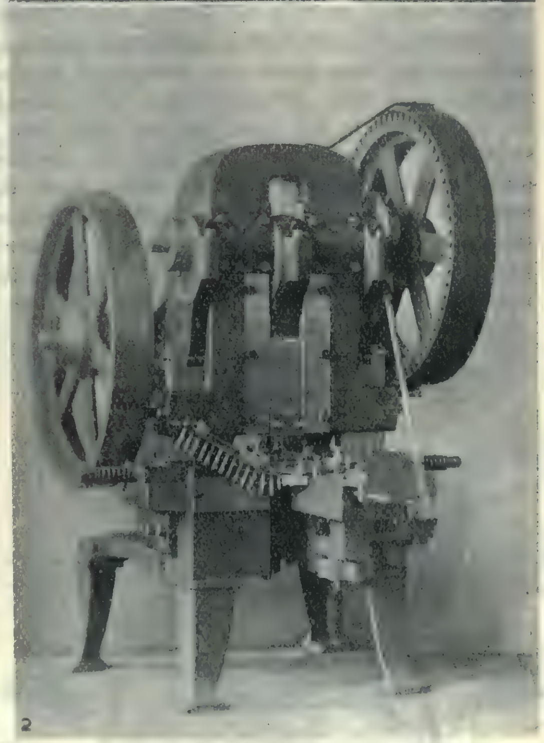


Fig. 1—Automatic trimmer for ½-in. bolts.

Fig. 2—Machine for trimming bolts up to 1-in. diameter of shank.

# UTILITY OF THE PEDRAIL.

By B. J. Diplock.

It has required some courage to attack the main characteristics of the wheel which has dominated the field of mechanical locomotion for several thousands of years, and I can only hope that a prolonged study of my subject will enable me to state the present position in such a manner that it may prove of some practical service.

The pedrail consists of only three main parts: the raliway; the circular revolving box; the sliding spokes and feet. The rail itself is made of case-hardened steel, and I estimate its life at 7,000 to 10,000 miles. It can then be replaced at small cost in a few hours.

The circular revolving box consists of two discs bolted together. It acts as a revolving framework to carry the sliding spokes and to keep them in line with the railway, and it also carries the casing to exclude dust and mud from the works.

With regard to the third spoke and foot, the railway roller is mounted centrally, and there is now no longer any overhang, while the ankle is enclosed in a crustacean cover, which I have found very effectual in keeping out mud and dust. The crustacean cover spreads out on one side of the ankle joint and closes into a small space on the other. Two rods are operated by a spring friction clutch on the roller, when the foot is in the air, but the moment the foot strikes the ground the friction clutch yields and the ankle joint allows the foot to accommodate itself to the road surface.

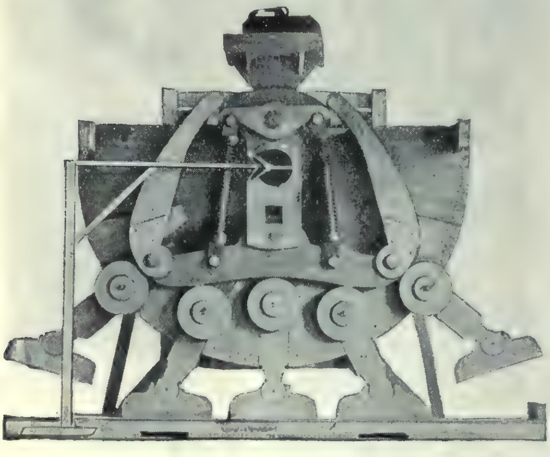


FIG. 1. LATEST WOODEN MODEL SHOWING NEW DESIGN OF RAIL.

The feet are soled with rubber in segments divided by strips of wood to prevent suction. If we now put the railway on to this roller, omitting the revolving box, it is easy to see how the railway works. The rail travels at the same speed as the main axle (see fig. 2), but whilst the rail is running over the roller, the roller itself is advancing by the walking action of the spoke.

### RECENT IMPROVEMENTS.

I now come to the most recent improvement, which has not yet been built, except in model form. (See fig. 1.) Here the rail and rollers are higher from the ground than they were, the rollers are closer together, and the concave portion of the rail reduced in length.

The proportion of rolling to walking movement is now two to one, instead of three to one, and as the walking movement causes less friction than the rolling movement, there is some saving in power. There is also a level projecting length of rail at each end of the three rollers, and this serves a very important purpose.

It will be noticed (see fig. 4) that with the improved arrangements, the roller gets well under the rail before the foot reaches the ground, and it will not surprise me if the saving in power due to this change amounts to even 25 per cent. This brings me to the most interesting part of this latest development. I refer to the means adopted for minimising the effects of horizontal deflection in road transport. It is the shock of the first impact that really tells in its effects on wear and tear, and the problem is this—how to arrange matters so that there shall be no horizonta deflection at that first impact? There is one very simple way of doing it, to add the weight of another locomotive, and the real remedy is almost as simple. All that is necessary is to hook the two side cams on to two arms projecting from the axle box, and so introduce the principle of compound leverage.

Up to this point there is no horizontal deflection; the obstacle has been absorbed in the mechanism, and now comes a beautiful movement; the engine rises to the height of the obstacle, not by shock, but by the expansion of its springs.

As the engine travels on, the springs again automatically compress in order to step gently off the obstacle.

When travelling at speed the first impact will not be wholly absorbed, although the shock will be greatly minimised, and on the other hand the engine will not have time to rise to the full height of the obstacle—the mean results will, therefore, be much the same.

I would here point out that the pedrail contains the three essential elements of the railway: the hard steel wheel; the hard steel rail; and the feet, or sleepers, which in a railway prevent the rail from sinking into the ground.

This brings me to that very important feature in railways—the area of the sleepers in supporting weight, which is represented in pedrails by the area of the feet. If we take an ordinary wheel and assume that the limit of moderately economical conditions is reached when the wheel bears on the road for, say, 3 in. of its circumference, and if we take 9 in. as the extreme useful width of tyre, we get a total bearing surface of 27 square inches. If we take the weight on this wheel at four tons (as authorised by a recent Local Government Board Order) the weight works out at 332 lb. per square inch.

A pedrail places two and three feet on the ground alternately, and taking the average at 2½ ft. and a weight of four tons, on a pedrail 5 ft. in diameter, the weight per square inch would be 38 lb.

But there is one remarkable and exceptional characteristic about the pedrail, that whereas in the wheel the bearing surface can never be economically increased, in a pedrail the area always increases in proportion to the square of the diameter. With four tons on a 7-ft. pedrail the weight per square inch would be 22 lb., and on a 10-ft. pedrail only 12 lb.

In these examples I have duly allowed for the extra weight of the larger Pedrails, and I think if you will study the significance of these figures—12 lb. as compared with 332 lb. per square inch—you will agree that I am not over-sanguine when I tell you that there will be no mechanical difficulty in the future in taking a 500-ton Pedrail train across, say, the Great Desert of Sahara, carrying its own fuel and water and yet leaving room for 200 or 300 tons of cargo, and what is true of the great desert is equally true of all the developed and undeveloped regions of the world.

Now in making this statement I wish it to be clearly understood that I am taking into account the immense benefits yet to be obtained on sand and soft ground by larger pedrails, the four pedrailed engine when further developed, and the improved shape of the rail in my latest design.

In the case of mining and other properties, instead of having to face enormous capital outlay on a railway to wait without profit whilst it is being built, and then to wait still longer whilst the output develops sufficient traffic to pay a profit on the railway, a single pedrail train could go to work at once, and even if the enterprise proved unsuccessful the pedrail train would still be available for use elsewhere, instead of the capital being sunk in the ground as in the case of the railway.

I have not yet made any statement of the loss in friction of the moving parts in the pedrail which corresponds to road resistance. In the pedrail there is no road resistance in the general acceptance of the term, since the pedrail does not roll on the road. Judging, however, by existing results, and allowing for the improved shape of rail and other improvements, the power required to drive a pedrail train will be about three times that on railways, slightly less than tramways, and that as compared with the wheel on the average road there will be a saving of power in the immediate future of about 60 per cent., and that with further development we may reasonably expect ultimately a saving of at least 70 per cent. Let me remind you, however, that this 70 per cent. will not be a mere saving of fuel consumption—the present heavy annual repairs and the absurdly short life of the motor wagon and traction engine are not all due to horizontal deflection, and if heavy road resistance necessitates the cramming of an extravagant power into the lightest possible frame, what can we expect but that the life of the road locomotive will be a short and a noisy one. With road resistance, vibration and horizontal deflection all reduced to a minimum. I see no reason why the life of the road locomotive travelling at slower speeds, should not be at least equal to that of the railway locomotive.

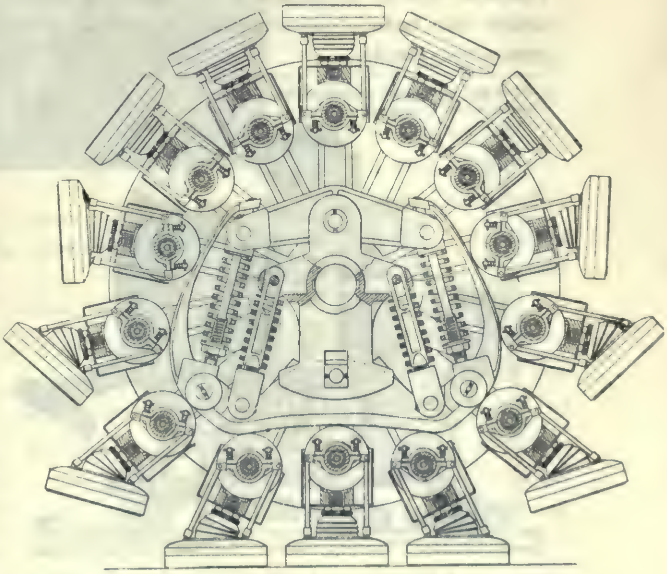


FIG. 2. SECTIONAL ILLUSTRATION SHOWING INTERNAL MECHANISM OF THE THIRD PAIR OF PEDRAILS.

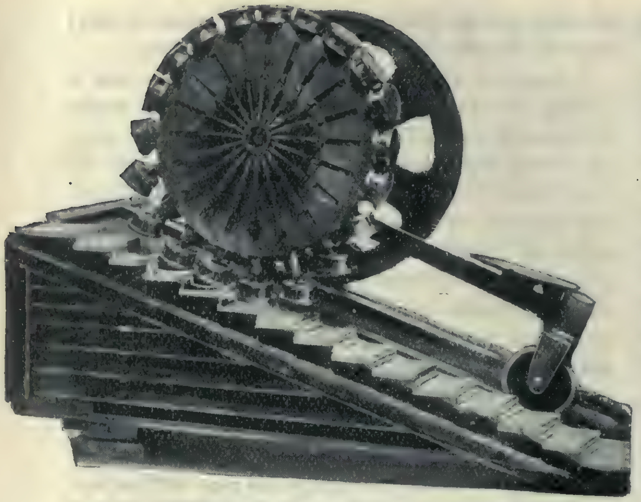


FIG. 3. FIRST PEDRAIL MODEL WALKING UPSTAIRS.

Time will not admit of my dwelling on the future advantages of the pedrail system for military purposes, such as the feeding of an army that need be no longer tied to a railway line for its supplies, and the benefits of taking the heaviest guns mounted on pedrails across open country. I will only state that an extended Government trial has just been completed successfully

In previous writings I have endeavoured to show that it may be possible with the pedrail system to transport goods locally at a rate of one penny per ton per mile. This would mean a rate from, say, Liverpool to Manchester, of about 3s. a ton, and I think, in time, this rate, with the advantage of the wagon top system might even include collecting and delivering within reasonable results.

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Abstract of lecture delivered before the Incorporated Chamber of Commerce of Liverpool.

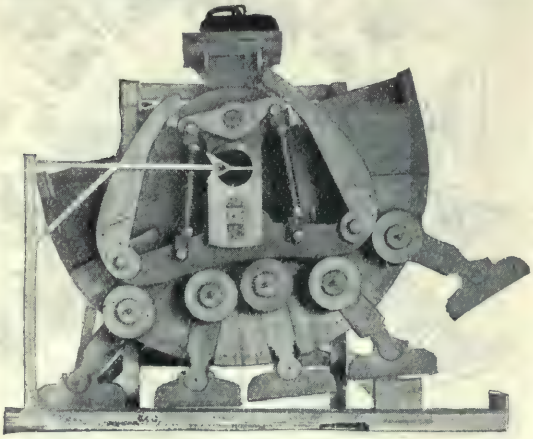


FIG. 4. LATEST MODEL SHOWING A 4-IN. OBSTACLE COMPLETELY "ABSORBED" IN THE MECHANISM.

# SHIPBUILDING NOTES.

On the 6th inst. the s.s. *Blacktor*, built by Messrs. Ropner and Son, of Stockton-on-Tees, for Mr. R. H. Holman, of London, made her official trial-trip in the Tees Bay. She is 330 ft. 1 in. in length, and has a deadweight carrying capacity of 5,150 tons. The engines are of the triple-expansion type, by Messrs. Blair and Co., Ltd., of Stockton, of about 1,200 i.h.p., having two steel boilers 15 ft. 3 in. by 10 ft. 3 in., working at 180 lb. pressure, fitted with evaporator, etc. Although the weather was stormy the trial trip was successfully carried out, and a speed of over 10 knots was maintained

The new steel screw steamer *Osprey*, just completed by Messrs. Archd. McMillan and Son, Ltd., Dumbarton for Mr. Hugh Flinn, of Liverpool, went down the Firth on her trial trip on Thursday last. The vessel, the dimensions of which are 140 ft. by 23 ft 6 in. by 10 ft. 9 in., with raised quarter deck, has been specially constructed for the fish trade. The machinery, which consists of a set of triple-expansion engines, has been constructed by Messrs. McKie and Baxter, Govan. On a six hours' trial, with the vessel fully loaded with 360 tons cargo, a speed of 11 knots was maintained.

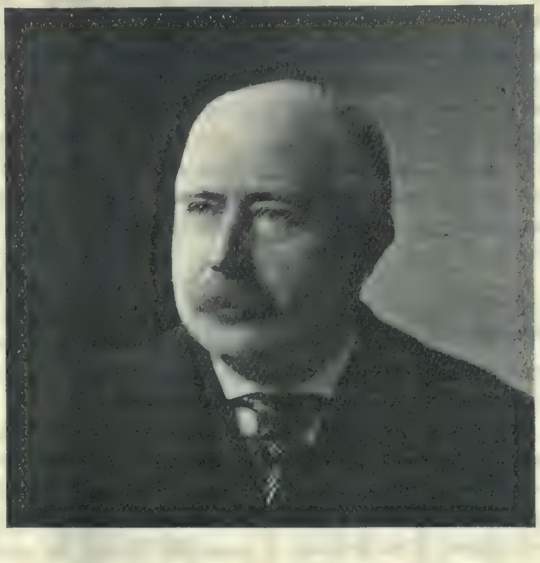
On Friday, April 7th, the steel screw steamer *Haverstoe* proceeded on her official trial trip in Hartlepool Bay, after adjusting compasses. The vessel is over 350 ft. in length, and has been built to the order of Messrs. Bennetts and Co., of Grimsby, by Messrs. Furness, Withy, and Co., Ltd., Hartlepool. She has a cubic capacity of 339,936, is built of Siemens-Martin steel, and takes Lloyd's highest class. Triple-expansion engines, with cylinders 24 in. 39 in., 66 in. by 45 in. stroke, and two single-ended boilers 16 ft. by 10 ft. 6 in. long, 180 lb. working pressure, have been fitted by Messrs. Richardsons, Westgarth and Co., Ltd., Hartlepool. The trial was in every way satisfactory, nothwithstanding the unfavourable weather conditions, the vessel maintaining a speed of over 11 knots.

There was launched from the shipyard of Messrs. Cochrane and Sons, shipbuilders, Selby, on Saturday, the 8th inst., a steel screw trawler, built to the order of Messrs. Coal and Carter of Milford Haven. The principal dimensions are 115 ft. by 21 ft. 6 in. by 12 ft. 9 in., moulded. She is being fitted with powerful triple-expansion engines by Messrs. Chas. D. Holmes and Co., of Hull, and will be replete with all the latest improvements for fishing with the Otto gear. She was christened the *Emerald* by Miss Ada Merrikin, of Hull.

# OUR WEEKLY BIOGRAPHY.

## WILLIAM GARRETT.

A STRIKING example of the obligations which America owes to British inventors is instanced in the case of the Garrett Rolling Mill. The inventor, William Garrett, was born in England in 1844. At the age of eleven he began to work in one of the rolling mills of Scotland, and at the age of sixteen he was foreman. Those who remember how exhausting was the labour in a rolling-mill before the introduction of modern machinery for the handling of heavy masses of glowing iron, will appreciate at its true value the fact that young Garrett, deprived of the privilege of attending school, secured his education by hard study after his long day's work was done. In almost any other occupation that could be named, this would be easier than in the one he followed, but his genius and ambition were superior to bodily fatigue.



WILLIAM GARRETT,
Inventor of the Garrett Mill.

In 1878, at the age of thirty-four, he went to the United States, and found employment for five years with the Cleveland Rolling Mill Company. In 1882, he brought out the first form of the deservedly famous Garrett Mill—the first rod-mill in which a No. 5 rod was rolled from a 4-in. (instead of a 2-in. or even smaller) billet, without reheating. On the same principle, the 4-in. billet could be rolled from the ingot without reheating, instead of first reducing the ingot to a bloom, and then reheating the bloom before rolling the billet. The saving thus achieved amounted at that time to about $7 per ton. It is said that about 80 per cent. of the rods now made in the United States are rolled in Garrett Mills.

In 1883, Mr. Garrett built at Pittsburg the rod-mill of the Oliver Wire Company's South Side plant. In 1886, he built a rod-mill at Cleveland for the American Wire Company. Still later, he became connected with the Joliet Steel Company, and built at Joliet, Ill., a rod-mill which is now operated by the American Steel and Wire Company, and has a wide reputation for its large output.

In 1897, Mr. Garrett returned to Cleveland, where he established, with Messrs. H. W. Lash and John C. Cromwell, the Garrett-Cromwell Engineering Company, which has done much of the new construction called for by large steel companies during recent years.

Like so many other self-made engineers, Mr. Garrett appreciated the importance of technical education and literature. He was a member of the Iron and Steel Institute of Great Britain, and also of a number of American technical societies.

He died July 15th, 1903, at Mt. Clemens, Mich., from a stroke of paralysis.

# POWER GAS PLANTS.

BY T. RIGBY.

IN my opinion the best possible practical solution of the question of which is the best gas for gas engines is to use producer gas in some form or other, as a high heat efficiency is so easily obtainable. A great number of these plants are working in different parts of the world, although they never found very great favour in certain parts of England owing to the fact that anthracite fuel is needed for their use. The use of bituminous slack for producing power gas has been experimented with for some years by various people, from the time of the late Sir William Siemens up to the present day, and it is only within the last few years that any degree of success has been met with. Quite a number of such bituminous gas producer installations are now at work with single producers, both on constant and variable loads, on day work and on continuous work.

The illustration on page 813 shows a gas plant of 4,000 h.p. capacity, designed for a central station abroad which is arranged for absolutely continuous running, duplicates being provided where necessary to enable this to be done.

### NEW DEVELOPMENTS.

It is with the use of producer gas on the regenerative system that great developments may be expected in the future. Within the last few years, and notably within the last year, gas power has been supplied for a number of central stations of moderate power in England, these being driven by anthracite or coke gas plants on the regenerative system. This development is likely to have a marked bearing on central station practice when using gas power. The working costs have been received of such a station which has been in use two years at Milford-on-Sea, in which the fuel costs are ·324d. per unit generated with coal at 27s. per ton.

It has been long known that gas coke is an ideal fuel for gas producers if the tar can be effectively removed from the gas, and in a particular plant of this type where every precaution was taken to ensure accuracy during the test and the dynamo had a very high efficiency, the final result was that 26·54 per cent. of the calorific value of the coal appeared as indicated work in the engine; 22·7 per cent. efficiency appeared as actual work at the engine crankshaft; and 20·8 per cent. efficiency as electrical energy at the dynamo terminals, which is the highest thermal efficiency yet authoritatively recorded of work obtained from solid fuel to my knowledge. One feature of the trial was the regularity and uniformity of the gas produced, the mean pressure of the indicator cards varying only 5 per cent. above and 1·25 per cent. below the average, throughout the trial.

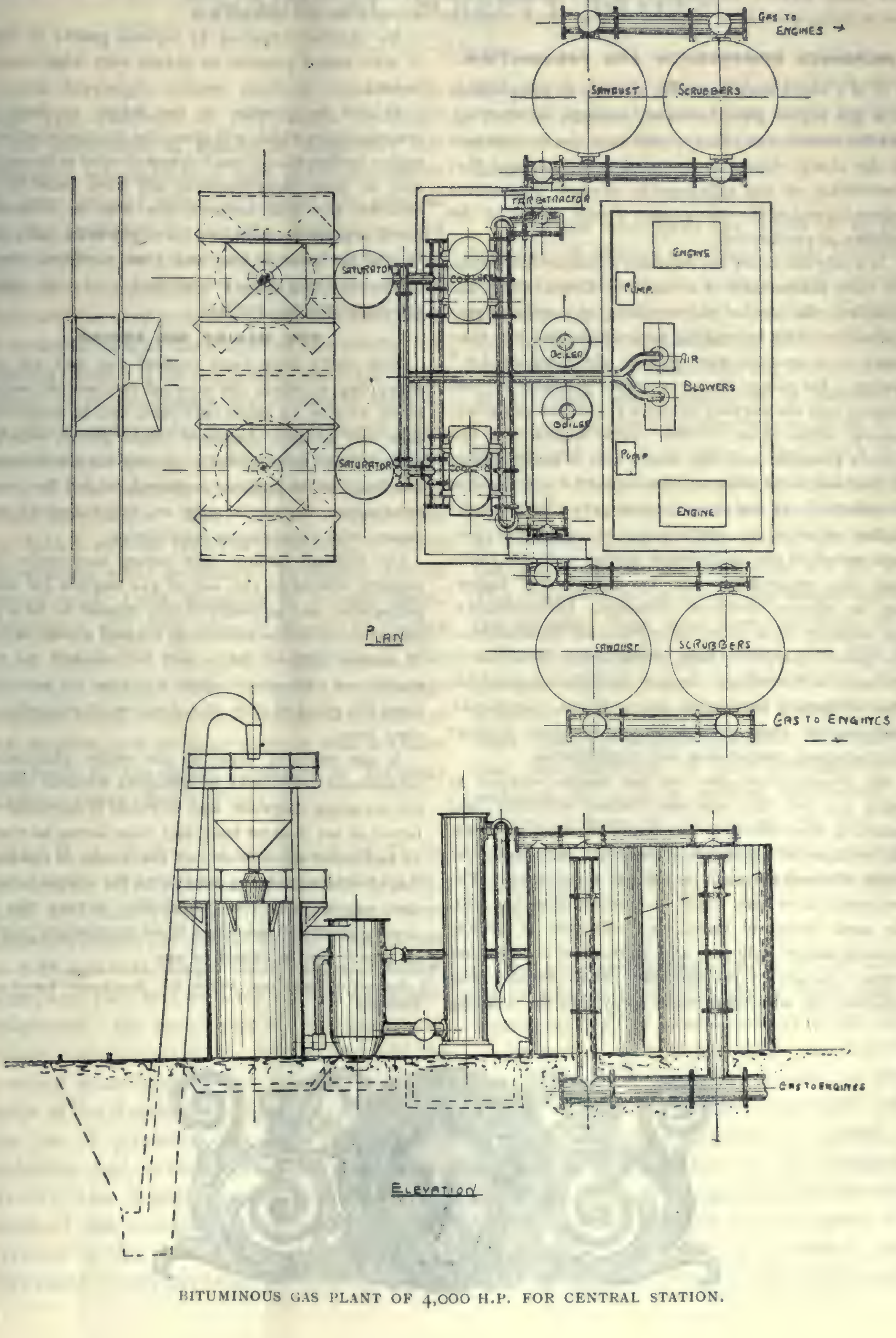
### ADAPTABILITY OF GAS PRODUCERS.

One of the great advantages of gas producers for variable loads is that great fluctuations of demand for power are instantly responded to, and the advantages of this adaptability will be appreciated by all central station engineers.

No central station exists in which common bituminous fuel is used, but I see no reason why such should not be employed as plants are now made from 80 b.h.p. upwards to any size. In such a station the fuel cost would be, in most cases, reduced to quite one-third that quoted as being possible with anthracite fuel, and any extra capital expenditure required, would be well compensated for by reduced running costs. Although the thermal efficiency is not so great as when using anthracite, still the low cost of fuel more than compensates for this. Several plants are in operation of 500 and 1,000-h.p., and with each increase in size they become slightly more economical.

Several installations are at work in which the exhaust gases are cooled by passing them through ordinary steam boilers, but only about half the total waste heat can be so utilised, owing to a portion of it being distributed over a large quantity of water, and the water evaporated in such boilers is only a very small proportion of the water necessary for cooling the jackets, so that the greater part of it cannot be used.

Where possible, as, for instance, where large quantities of hot water are required, it is more economical to pass the cooling water from the jackets through some form of water heater, the exhaust gases being also passed through this water heater. When properly arranged, half the total heat of the gas admitted to the engine can be recovered in this way, and waste heat from gas engines aggregating 1,000 h.p.



BITUMINOUS GAS PLANT OF 4,000 H.P. FOR CENTRAL STATION.

has been treated successfully in this manner, the water being used for a large battery of steam boilers.

### INCREASED COMPRESSION AND PRE-IGNITION.

It is a well-known fact that increase of compression in a gas engine gives increased economy of working, but the trouble has hitherto been that the temperature of the charge during compression is so increased that combustion of the inflammable mixture commences before the end of the compression stroke, giving all the troubles of pre-ignition.

As a rule the richer the mixture, within certain limits, the more inflammable it is, and Mr. Dugald Clerk has conceived the idea of endeavouring to overcome pre-ignition troubles by making the mixture less rich than usual, in a peculiar way, termed the "Added Air" system. He pumps the air or cooled products of combustion into the working cylinder at the end of the admission stroke of an "Otto" cycle engine at a few pounds pressure, with the result that a larger charge of combustible is retained than usual for a given size of cylinder. At the same time he gets a little stratification of air to gas, and a cooler charge at the commencement of the compression stroke, with the result that the compression can be permissibly higher, and he obtains increased economy. Unfortunately, the negative work taken up in pumping the additional charge is comparatively large, and although the indicated efficiency is fairly high, the actual efficiency available after deducting mechanical losses, is not exceptional, and possibly lower than is usually obtained, without the increased compression and complication.

Mr. Dugald Clerk gives the best results obtained as being 34·4 per cent. indicated thermal efficiency, and assuming that owing to his heavy mechanical losses, his mechanical efficiency is only 75 per cent., the actual thermal efficiency is only 25·8 per cent. Experiments have been made in another direction with the same object in view, viz., reduction of trouble through heated cylinders and increase of compression without danger of pre-ignition. The problem was attacked by admitting water spray into the working cylinders during the suction stroke of the engine, this being done in a special way.

By careful attention to various points of design, it was found possible to obtain very high economy indeed.

It will be possible in the future to reach coal consumptions which will place the internal combustion engine further ahead than it is now of other prime movers, and as these improvements are from time to time effected, the coal consumption will be reduced till it will be possible to obtain a horse-power for half a pound of coal per hour or less, and I am confident this will not be very long at the present rate of advance of power gas apparatus and engines.

### THE MARINE GAS ENGINE.

New fields have been opened out and are being every day in which the internal combustion engine is likely to play an important part, and in nearly every case this advance displaces steam power, which the writer thinks he is correct in saying, has almost reached the limit of its possible economy, whilst the internal combustion engine is only on the threshold of its career, with encouraging possibilities.

Sir William White and other authorities have recently discussed the use of gas engines for marine propulsion, and although it may appear to be a great departure it will be sucessfully applied sooner or later. If marine engines can be run for one-half to three-quarters of a pound of coal per h.p. hour the advantages from the point of view of a designer of steamships are very great.

A gas producer plant to use either anthracite or bituminous coal could be designed without difficulty for sea-going purposes, and it would if anything work better at sea than on land, and there seems no obstacle to successful application but the design of the engine. Rapid strides are being made with the internal combustion engine, and the probability is that the next twenty years will see ocean liners successfully propelled by power gas, in extensive use.

Abstract of paper read before the Manchester Association of Engineers.

# TECHNICAL SOCIETY NOTES.

Lord Rayleigh, whose portrait appears on page 779, received a very warm welcome at the Institution of Electrical Engineers last Thursday, where he took part in the discussion on International Electric Units. He pointed out the tendency to beg the question on the part of certain reformers by the assumption that there is no uncertainty about the value of the ohm, and he very properly preached the gospel of conservatism in the matter of disturbing the existing units. The suggested innovations in regard to nomenclature are evidently little to his liking, and a great many other people have rooted objections to multiplying names when some of those already invented have in practice fallen into disuse. Many are of opinion that the C.G.S. system requires no names, it being self-evident what is meant. Professor Ayrton agreed with Lord Rayleigh as to the shortcomings of the ohm, when it sought to appear in an unsuitable rôle, and he explained, with his usual lucidity, the basis of an attempt which is being made to ascertain the value of the ampere, and to determine it with a nearer approach to the ideal condition of accuracy than any other electrical unit.

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Mr. R. A. Trotter, of the Board of Trade, came next. He stated his intention of speaking quite unofficially, and yet his utterances were distinctly cast in the official mould. The burden of it all was that things were very well as they were, and that this zeal for reform was a little misplaced. Mr. Smith, one of Dr. Glazebrook's young men, wound up the debate, and told the meeting something of the experiments being made at the National Physical Laboratory with the view of obtaining data for a new Clark or cadmium cell, wherein he agreed with Mr. Trotter, who thinks that the only part of the work of the committee of 1890 which needs revision is the definition of the Clark cell. Mr. Smith would have told the meeting a great deal more about units and standards, but a concrete standard in the shape of the institution clock prevented him, and the discussion was therefore adjourned.

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At the last meeting of the North of England Institute of Mining and Mechanical Engineers, interest turned upon a new coal conveyor, recently adopted at the Prudhoe Collieries, and which was described by Mr. J. W. Batey. This works in a seam varying from 19 in. to 30 in. thick, and consists of a shallow tub 7 ft. long at the top tapering to 6½ ft. at the bottom and 2 ft. 8 in. wide. The depth at the back is 11 in. and at the side next the coal face 7 in. The wheels are 6 in. in diameter, the axles being placed at each end of the tub, and the gauge of the conveyor road is 2 ft. 10 in. The conveyor is run along the whole width of the working face, and over the tops of the ordinary coal tubs, into which the coal falls through sliding doors in the bottom of the conveyor. The conveyors are hauled by a wire rope run over a pulley-wheel. It is claimed that the adoption of this arrangement has reduced the cost of putting, stonework, and shift work from 1s. 2d. to 8d. per ton. The discussion indicated that this was a successful adaptation of an old system to modern requirements.

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The suggested amalgamation of the London Institution with the Society of Arts does not commend itself to some members of the former body, and a circular has been issued pointing out the need for an earnest attempt to extend the work of the London Institution on its present lines before its assets are handed over to another body under the thin disguise of amalgamation. It is suggested that the scheme means in plain English that the assets of the London Institution are to be used to provide a commodious building for the 3,800 members of the Society of Arts, and such of the 950 proprietors of the London Institution as may choose to amalgamate with this body. It is also pointed out that the scheme is diametrically opposed to the views of the London Institution Board as expressed in their last annual report. No decision on the matter was reached at the meeting held on Wednesday.

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A paper dealing with the design of concrete steel beams was read by Mr. W. Noble Twelvetrees before the last meeting of the Civil and Mechanical Engineers' Society. It was pointed out that adhesion of the concrete to the steel is a matter of prime importance, and that the correct union produces what is practically a new material, possessing the solidity that characterises masonry construction while ensuring ample stability, strength and stiffness. Although the steel used as reinforcement has to resist shearing and compressive stresses, its primary function is to resist tensile stress. A further duty of the reinforcement is to ensure the thorough distribution of strain. As the literature of the subject is scattered over many sources, mainly of foreign origin, the author of this paper has given a few simple formulæ based upon the rules used for the calculation of beams, and while not professing that they are the absolutely best formulæ, the whole subject being in a condition which requires further investigation, he claims that the formulæ set out in the paper will give results which practically agree with more complicated forms of mathematical expression.

# LAUNCHES.

The fleet of the Indo-China Steam Navigation Co., Ltd., will shortly be increased by a large steel screw steamer which was launched on Wednesday, the 5th inst., by Messrs. Swan, Hunter and Wigham Richardson, Ltd. This vessel, which is intended for their Eastern service, is 400 ft. in length by 51 ft. in breadth, and will carry a large cargo as well as having accommodation for both European and Chinese passengers. The European passenger accommodation will be on the bridge deck, and the first-class Chinese passengers will be under the bridge deck. There will also be accommodation for a good number of second-class Chinese passengers in the poop. The vessel is to be propelled by a set of quadruple expansion engines supplied with steam by three large boilers, all of which are also being constructed by Swan, Hunter and Wigham Richardson, Ltd. As the vessel left the ways she was named the *Kut Sang* (meaning "Lucky Increase"), the christening ceremony being performed by Mrs. Alfred Finch, of Newcastle-on-Tyne.

Messrs. Ramage and Ferguson, Ltd., launched on the 6th inst., from their yard at Leith, a steel screw steamer built to the order of Mr. Thomas Cowan, Leith, for trading between Leith, Dundee, Southampton and Treport. The vessel, which is of the raised quarter-deck type, with bridge and long topgallant forecastle, has been constructed to Lloyd's highest class, and is fully equipped with all the most modern machinery for handling cargo. She is provided with steam steering gear, steam windlass, steam warping capstan, and a full installation of electric light. The principal dimensions are: Length, 218 ft.; beam, 33 ft.; depth, 15 ft.; and the machinery consists of a set of triple expansion engines having cylinders 18 in., 30 in., and 49 in. diameter, and 33 in. stroke; steam being supplied from two large steel boilers, working at 170 lb. pressure. On leaving the ways the vessel was named *Ploussa* by Miss Annie Motherwell, of Rawyards House, Airdrie.

On Wednesday, April 5th, Messrs. William Gray and Co., Ltd., launched the steel screw steamer *Pruth* for the Mercantile Steamship Company Ltd., London. She will take the highest class in Lloyd's, and is of the following dimensions: length over all, 371 ft. 6 in.; breadth, 50 ft. 3 in.; and depth, 28 ft. 3 in.; with two decks laid and long bridge, poop and top gallant forecastle. The hull is built with deep frames cellular double bottom. She has all the requirements for a first-class cargo steamer.

Triple expansion engines are being supplied by the Central Marine Engine Works of the builders, having cylinders 25 in., 42 in., and 70 in. diameter, with a piston stroke of 45 in., and two large steel boilers, to work at a pressure of 180 lb. per square inch. The ship and machinery have been built under the control of the owner's superintendent, and the naming ceremony was performed by Miss Dorothy Cooke, of London. This is the 700th vessel built by the firm.

# UNSOLVED PROBLEMS IN ELECTRICAL ENGINEERING.

COLONEL R. E. B. Crompton delivered the "James Forrest" lecture for 1905, at the Institution of Civil Engineers on Monday evening. The following is an abstract.

The electrical problems which form my subject divide themselves into two groups, those set for us by Nature herself, and which chiefly concern the scientific investigator, and those which have presented themselves to engineers since we began to use electrical energy for man's service.

The problems of lightning discharge have from the very first interested us, and in these later days of large power schemes, the importance of protecting our works against lightning stroke has become increasingly evident.

I have been slowly gathering evidence during the last few years, and find that most of the engineers who have studied this question are in agreement with me, that our present methods of detecting or guarding against the effects of frequent and hitherto unnoticed static discharges, are altogether inadequate to protect our works, and that we have here presented a question of extreme difficulty and importance.

Professor Elihu Thomson reminded me of the undoubted fact that lightning strokes as they pass through the air very frequently follow one another over nearly if not the same identical air path. He seems to think—but this requires confirmation—that the dielectric strength of the air at this point is reduced or partly broken down by the passage of a powerful lightning stroke which facilitates the passage of subsequent strokes at the same point. Are we to conclude that corresponding conditions of weakened path are set up below the earth's surface and consequently affect us by affording paths for disruptive discharge through our underground mains?

The problems surrounding terrestrial magnetism are as yet unsolved, but we have reason to believe that the earth's magnetic field is not symmetrical.

Another problem is that of the etheric transmission of power. The development of electric wave telegraphy is an excellent instance of the various stages of the solving of an electrical problem.

We may consider that the etheric transmission of signals up to a given distance, and notably for the purposes of signalling to and between ships at sea is practically solved, although there are many secondary problems arising out of it. No doubt the first and most important of these is the production of wave trains sufficiently powerful and of the right character to yield the best results.

### ETHERIC TRANSMISSION OF POWER.

Fleming has shown that in all probability the method that we have arrived at at our present stage of development to communicate waves to the ether by the oscillating discharge of condensers onl extends over probably over one per cent. of the time available, in fact, that we only have a series of intermittent waves with long vacant spaces intervening. What we require is a better method of originating a continuous train of waves rather than these intermittent ones, and here we can formulate our problem, which may be solved by the mechanical engineer, or probably by the electro-chemical engineer. The solution of this problem of continuous operation by means of Hertzian waves appears to be extremely hopeful, and at any rate it is one of first importance.

As to the etheric transmission of power on a large scale, as foreshadowed by Tesla, it is difficult to speak with any certainty or even hopefulness. It is evident that the consequences which would follow on the etheric transmission of considerable amounts of power would be so startling, from every point of view, that they would revolutionise our ideas socially and politically, and would profoundly affect all our present conditions of life.

I now come to the second group of problems connected with the development of electrical machinery in the form that it is now taking, and with which I have personally been most in contact during the past twenty-five years.

Take the core first. So long as these were of cast-iron the permeability was low and results therefore poor. Later on the steel founder was able to make for us castings of high permeability; but when we began to develop the use of alternating machinery, or whenever the cores were subjected to alternating electrical stresses, we met with the difficulty that eddy currents were set up within the cores, followed by heating, and in addition we observed for the first time the losses due to hysteresis.

### CORE AND COIL PROBLEMS.

When we first formulated our requirements for core material they were simple. We only stipulated that it must be permeable, easily cast, forged or worked into the shapes in which we required to use it, of sufficient mechanical strength and easily cut or shaped up by machine tools. These requirements were easily met by the addition of small percentages of nickel and aluminium, as the use of these alloys produced cores with extreme permeability; but when it became of extreme importance to minimise eddy currents, we found it necessary to mechanically subdivide our cores either by slotting or sawing the solid castings or by forming our magnet arms of thin wrought-iron plates, which are held in position by being cast into cast-iron or cast-steel yokes. But at this stage we encountered an annoying difficulty, which still exists and has been the cause of much disappointment and loss to steel founders and dynamo builders. I refer to the difficulty in producing steel castings for magnets, yokes and frames sufficiently free from blow holes or porosity to ensure that the magnet core portions are of equal density of mass and therefore of sufficiently equal magnetic moment.

This difficulty is a real one, and may possibly be met by further developments of Barrett's discovery that the addition of silicon in suitable proportions to cast iron renders the whole very fusible, so that complicated and difficult castings free from porosity can be made from it, but in addition he has shown that we have the great gain from it as it reduces hysteresis. This discovery therefore, points in the direction from which we may hope to obtain considerable improvement in our magnet cores. In the other the class of cores, particularly those subjected to alternating electrical stresses, such as the cores of transformers, we cannot hope to obtain sufficient freedom from the losses due to eddy currents by means other than minute subdivision, that is to say, by lamination, or in some cases by forming the cores of a bundle of individual wires.

I cannot leave the core question without referring to the interesting discoveries of Dr. Heusler of magnetic non-iron alloys. Dr. Hadfield has produced for Dr. Fleming rings formed of an alloy of aluminium copper and manganese which is nearly as magnetic as a low grade of cast-iron although it contains no iron at all. It is possible that the whole secret of magnetism is locked up in these rings, at any rate the discovery is of extreme importance, and may have wide reaching influences on the question of our cores.

From the first we found that the most convenient method of forming our existing coil or helix was by winding up into a coil on the core itself, or on a separate frame slipped on to it, copper wire of circular cross section, and covered with a fibrous insulating material such as cotton or silk thread.

### AN IDEAL WINDING.

An ideal winding would consist of thin copper strip wound on its edge into correct position by suitable machinery, each turn being insulated from the adjacent turn, by a thin film of insulating material applied to it at the time it is being wound. This ideal form of coil winding has already been occasionally used in practice for the larger coils required for certain transformers and for the magnets of large generators and motors, and we gain greatly in reducing bulk of the winding, weight and cost of copper.

We now come to insulating problems. Up to the present we have been content with the older method of fibrous insulation, some times untreated, but in other cases impregnated with an insulating varnish or enamel.

What we now know points to the desirability of dispensing with fibrous material and of replacing it by an insulating material which will have sufficient dielectric strength, will stand the action of nitric acid and facilitate heat conductively. A good deal has been recently done in this direction, and notable advances have been made towards increasing the temperature up to which such insulating compounds can be worked without notable decrease of their dielectric strength, and it is quite reasonable to hope that our chemists will furnish us with suitable insulating materials for impregnation, or coating our conductors and which will stand continuously temperatures up to at least 200 deg. C. or 390 deg. F. If we are successful in obtaining reduction in the sizes of our coils, and in obtaining the higher temperatures at which we can work them without endangering the durability of our plant, we shall benefit greatly, both constructors and users, by reducing the bulk, weight and cost of our machinery without in any way impairing its efficiency.

The recent introduction of high-speed turbo-generators has called attention to the difficulties of designing both the cores and the winding of the revolving fields so that they can successfully withstand the severe mechanical stresses to which they are exposed at these extreme speeds. Here the difficulties of the design are very great and the problem of overcoming them is yet in its early stages.

### ELECTRICAL STORAGE DEVELOPMENT.

Although we are agreed that the development of electrical storage is desirable from every point of view, we engineers are still divided into two camps, those who believe in storage in its present stage of development, and those who hold the contrary opinion. I have from the first held strongly to the former view, as I have all along considered that in the lead-couple accumulator we have a most valuable means of obtaining sufficient storage for our purposes.

It may surprise many of you to hear how great have been the improvements in the lead-couple accumulator during the fifteen years or so that it has been in practical use.

These improvements have been noticed by those who have closely studied this question, and have been followed by a great increase in the use of storage, especially where the demand on the electrical energy has been intermittent, or has been confined to short hours, such as in towns or villages where the demand up to the present has been principally for domestic purposes during hours when artificial light is required; so that at present my view is that we can design far the most economical plant for supplying electrical energy for these cases by combining the most economical generating plant that we know of, which is the combination of the internal-combustion engine with a suction gas-plant worked for long hours, and thereby charging storage sufficient to deal with the bulk of the load, but supplying the short hours of peak load from steam plant specially desgined to work for short hours at a maximum efficiency.

The storage problem which has been insufficiently developed, but to which much attention is now being directed, is that of portable storage. It is quite certain that an enormous impulse would be given to the production of electrically-driven vehicles when the boxes of accumulators and the means of charging them are sufficiently standardised.

The railway problem is of the highest interest and importance. I must confine my remarks to pointing out that one solution of the problem seems already within our reach, namely that of the utilisation of single phase alternating currents for long-distance transmission which only requires two insulated wires and two contacts. The engineering and mechanical secondary problems still unsolved are easy ones. We have the choice between the type of series motors as made by Finzi in Italy, and that of the Winter and Eichberg compensated repulsion motors made by the Allgemeine Company.

As regards the problem of the third rail, its difficulty and dangers, and of substituting the overhead work necessary for these single-phase motors, it is a mere draughtsman's question, and is quite certain to be satisfactorily dealt with. I think we can even now answer two questions. The first is:

### ELECTRIC TRACTION COMPARED WITH STEAM HAULAGE.

Can electric traction supersede the present steam-haulage at the schedule speeds which are at present in use on our railways? To this question electrical men say that, although there are many secondary problems arising out of it, they are all easily solvable, and we have no doubt whatever that we can answer the question in the affirmative. The second railway question is: Can we by the introduction of electric haulage raise to a notable degree the present schedule speeds, and from this cause alone become very formidable competitors to long-distance steam haulage? Although there are many electrical engineers who would answer this question in the affirmative with as much confidence as they answer the first one, yet personally I am not quite so sure. I see that, spurred by our electrical competition, the designers of the steam locomotive are likely to make further efforts and I feel sure that if we electrical men can work to schedule speeds of 100 miles an hour, the steam locomotive also can be improved so as to work at the same speed with equal safety.

As to long-distance goods traffic, I do not think we are likely to attack this problem for years to come. None of the engineers I have talked with, either in England or America, seem to think that electricity is ever likely to replace steam for this work, of course I mean in our present knowledge of the generation and supply of electrical energy.

The solution of the problem of producing by electrical means a change of speed and torque-gear will be of the utmost value in aiding the work of the mechanical engineer, whether in railway works, rolling-mills, cranes, hoists or in the propelling mechanism of the steam, petrol or electrical vehicles which are now beginning to be used so largely on our roads.

Probably the branch of electrical engineering, which has already made its greatest advances, has been that of perfecting our measuring instruments. Much is to be hoped for from the further development of the beautiful spherical electrostatic instruments devised by Price.

Finally, I believe the greatest problem of all, and the one which will have the most profound influence on the wellbeing of our fellows, is the satisfactory development of our power schemes by which we hope to send the population back to the land.

# OPENINGS FOR TRADE ABROAD.

### Belgium.

The Société National des Chemins de Fer Vicinaux invite tenders for the supply of six hydraulic cranes. Specifications and plans may be obtained from the General Manager, 14, Rue de la Science, Brussels, to whom tenders must be posted not later than the 18th inst.

Tenders, which should be posted not later than the 30th inst. to M. Van Gansberghe, Directeur des Ponts et Chaussées, 1, Square Stéphanie, Ostend, are invited for the carrying out of certain port improvements at Ostend, at the estimated cost of about £31,170. A deposit of £1,600 is required to qualify any tender. Plans and specifications may be obtained from the above-mentioned address.

The adjudication will shortly take place of tenders for the construction of six locks on the Charleroi-Brussels Canal. The estimated cost of the work is about £68,966.

Tenders will be opened on the 19th of April at the "Bourse de Commerce," Brussels, for the construction of a railway between the Place Verboeckhoven and the Place Armand Steurs in that city. The estimated cost of the work is about £13,636. Specifications may be obtained from the Chief Engineer, M. L. Motte, 13, Rue de Brabant.

### Chile.

The Senate has sanctioned the construction of an electric railway, which, starting from the port of Valparaiso, will pass through the Casablanca and Caracavi Valleys and communicate with Santiago by the West, having a branch line connecting the Caracavi Valley with the town of Nelipilla. The entire length of the line will be about eighty-nine miles. All the materials, implements and machinery imported for the construction and exploitation of this line are to be free of Customs duties.

### Portugal.

On the 9th prox., at the Directorate-General of Public Works and Mines, Lisbon, tenders will be opened for the construction of a bridge, with metallic platform, over the road from Mectola to Villa Real de Santo Antonio, in accordance with plans on view at the aforementioned office. Local representation is necessary, and a deposit of £83 is required to qualify for any tender.

### Portuguese East Africa.

A despatch has been received at the Foreign Office from H.M. Chargé d'Affaires at Lisbon (Mr. A. R. Peel), reporting that a contract was signed on the 10th March between the Portuguese Government and the Bank of Lisbon and the Azores for a loan of £400,000, the greater part of which is to be utilised for the construction of the Swaziland Railway.

### China.

A consular report from Hangchow calls attention to the good prospects for the sale of motor-boats in China. The country is covered with a network of canals and rivers, upon which motor-boats, especially those of light-draught capacity, can be worked. During recent years the general mode of travel has been by house-boat, towed by a steam launch, and, says the Consul, it will be many years before this method of transport is displaced by railways; but in the meanwhile there is a growing favour for power boats. The motor-boat, as it is now made, is practically unknown in China. In Shanghai and other prominent trading points on the coasts there are a number of modern small launches, but the great interior is practically untouched. The popular-sized, medium to cheap grades of boats are what are required in China. As a rule, the Chinese are good boat builders when they have good models to work from, and it would be practicable, remarks the Consul, for boat builders to ship boat machinery and have the hulls made in China.

### Uruguay.

We understand that a petition will shortly be presented to the Monte Video Legislature, asking for the admission into the country of a hundred automobiles, free of import duty. Automobiles are practically unknown in Monte Video, only four or five being found in the capital. The reason for their rarity is, it is stated, the high duty, which adds 50 per cent. to their cost. It is hoped that the temporary remission of duty, which is strongly supported by several deputies, will give rise to a strong demand for these vehicles.

### Sweden.

It is reported that the Swedish State Railways' Department are about to submit a project to the Riksdag for the purchase of the waterfalls near the principal lines, at the cost of 4,000,000 crowns. These falls would, it is said, furnish sufficient electric power for the running of the trains.

# CONTRACTORS' NEWS.

**We shall be pleased to insert under this column, free of charge, particulars of open contracts.**

## CONTRACTS OPEN.

Last Day.

**Foffanyreagh (Ireland).**—Construction of a storage reservoir of about 75,000,000 gallons capacity at Foffanyreagh, near Newcastle, in the county of Down, for the Portadown and Banbridge Joint Water Board. Plans and specification may be seen at the office of Mr. R. H. Dorman, Court House, Armagh, or at the office of Mr. William Wilson, clerk to the Joint Board, Town Hall, Portadown April 17

**Cardiff.**—Following plant for their power station on the extra high-tension system, for the Cardiff Corporation, viz.: extra high-tension three-phase main switchboard for power station; switchboards for sub-stations; motor generators, rotary converters, etc. Mr. Arthur Ellis, borough electrical engineer, and manager, Central Office, The Hayes, Cardiff ... April 17

**Batley.**—The following works in connection with the extension of the tramways in Bradford Road, for the Corporation: (Contract No. 14) permanent-way construction and paving; (15) overhead equipment, steel poles, etc.; (16) feeder cables, conduits, and accessories. Messrs. Lacey Sillar and Leigh, 2, Queen Anne's Gate, Westminster, S.W. ... ... ... April 17

**Glasgow.**—Electric power generating and lighting plant for Clydebank Dock, for the Trustees of the Clyde Navigation. Mr. T. R. Mackenzie, general manager and secretary, 16, Robertson Street, Glasgow, or from Mr. Geo. H. Baxter, mechanical engineer ... ... ... ... ... April 17

**Aberdeen.**—Supply of one surface condenser, with air pump, oil separator, etc., for the Electricity Department. Mr. J. Alex. Bell, city electrical engineer, Corporation Electricity Works, Millburn Street, Aberdeen ... ... ... ... April 19

**Merthyr Tydfil.**—Construction of certain waterworks, consisting of an aqueduct from the existing Neuadd resorvoirs in the Taff Fechan Valley, and extending for a distance of about 16 miles towards the southern boundary of the district, for the Merthyr Tydfil Urban District Council. Mr. Geo. F. Deacon, 15, Great George Street, Westminster, S.W. ... ... April 19

**Stockport.**—Supply of one 500-k w. steam generator for the Gas and Electricity Committee. Mr. A. J. H. Carter, Electricity Works, Millgate, Stockport ... April 26

Last Day.

**Colchester.**—Supply, delivery, erection, fixing, laying, jointing, setting to work, and maintaining for a given period, a triple-expansion horizontal pumping engine of the Worthington type, a multitubular steel boiler, traveller, cast-iron pumping and suction mains, with connections to existing mains, for the Corporation. Mr. G. E. Bland, Waterworks Superintendent, Town Hall, Colchester ... ... ... ... April 24

**Croydon.**—Deep-well pumping engine and boilers for the Stroud Green well, Woodside, Croydon, for the Croydon Town Council. Mr. Geo. F. Carter, A.M.I.C.E., borough engineer, Town Hall, Croydon... April 26

**Manchester.** — Construction of a new curve and the widening of a portion of their main line at Throstle Nest, Manchester, for the Cheshire Lines Committee. Mr. Harry Blundell, engineer to Cheshire Lines Committee, Central Station Liverpool ... ... ... ... ... April 27

**Wimbledon.**—Supply and erection of the following plant in connection with electricity works for the Wimbledon Urban District Council: a 1,000-kw. steam-driven turbo-alternator, with condensing plant, high-tension switchgear, and pipework. Mr. H. Tomlinson-Lee, Electricity Works, Durnsford Road, Wimbledon ... ... April 28

**Bishop's Stortford.**—Carrying out of the following works at their sewage pumping station, for the Bishop's Stortford Urban District Council: (Contract No. 1) For supplying and fixing two Lancashire boilers, 18 ft. long by 6 ft. 6 in. diameter; (2) for supplying and fixing steam pumping engine and pumps. Mr. Thos. Swathebridge, 7, North Street, Bishop's Stortford ... ... ... ... May 8

**New South Wales.**—Tenders will be received at the office of the Secretary for Public Works, Sydney, Australia, up to 2 o'clock p.m. on Friday, September 1st, 1905, for the manufacture, supply and delivery in the State of New South Wales of all iron and steel required by the Government. Full particulars may be obtained from the Agent-General's office, 9, Victoria Street, London, S.W. ... Sep. 1

## COMING CONTRACTS.

**Warwick.**—The new scheme for augmenting the water supply at Warwick involves the construction of a reservoir to hold 500,000 gallons, the sinking of a well, the erection of an engine-house, and the laying down of pumping machinery. Messrs. Wilcox and Raikes are the engineers.

**Norwich.**—An inquiry was held on Tuesday into the application of the Town Council for sanction to borrow £30,000 for electric lighting purposes. The Town Clerk in his evidence said that whereas in 1902, there were 2,635 consumers, there were now 3,277, and the 8 c.p. lamps equivalent was 125,700 now against 99,180 then.

**Erith.**—Sanction has been received to the borrowing of £19,878 for the purposes of the electric lighting undertaking.

**Derby.**—Application has been made for sanction to a loan of £9,600 for a 500 kw. turbine dynamo and condensing plant, extension of mains, etc.

**Dover.**—The Board of Trade have granted the Council's application for a Provisional Order for public works in the parishes of River, Ewell, Whitfield, Guston, Westcliffe, and St. Margarets, with part of Alkham.

**Brixham.**—An inquiry has been held into the application of the Urban District Council for sanction to a loan of £7,350 for waterworks.

**Doncaster.**—The Corporation propose to expend £7,500 on the extension of their electricity works.

**Ribble Navigation.**—The main proposal of this Bill is the extension of the existing training walls to the estuary of the Ribble, a distance of three and a half miles, and a further expenditure on the equipment of the dock. The total cost is estimated at £200,000.

## CONTRACTS CLOSED.

**South Shields.**—The Tramways Committee have accepted the tender of Wm. Underwood & Bros. at £42,903 for the construction of tramway permanent way and track and for bonding at £770, the tender of Dick, Kerr and Co. for generators at £2,695, and of J. and H. McLaren for engines at £8,400.

**Stoke Newington.**—The Council have placed an order with Bruce Peebles & Co. for two 120 kw. motor-driven balancers, seven 50 kw. transformers, switch gear, &c.

**Stockport.**—The Gas and Electricity Committee have accepted the tender of Johnson and Phillips for supplying and laying feeder and test cables in connection with their tramway extension.

**Bolton.**—The Corporation have placed an order amounting to £466 10s. with the Key Engineering Co. for Cowan-Andrews remote control switch gear for their high-tension 3-phase extensions.

**Rochdale.** — The Corporation have accepted the tender of Bruce Peebles and Co., for three 120-kw. motor converters.

**Barking.**—The Council have accepted the tender of Babcock and Wilcox for a boiler, feed pump, water softener and storage battery at £1,638.

**Leith.**—The Tramways Committee have accepted the tender of the British Insulated and Helsby Cable Company for the grooved wire required in the overhead installation for the new tramway system, at £1,195 0s. 6d.; and the tender of S. Dixon and Son for the fittings to be used in connection with the wire, at £894 7s. 9d.

**Croydon.**—The Corporation have accepted the tender of Callender's Company, for the supply of cables for the next twelve months.

**Suez Canal.** — The General Electric Company, London, have placed an order with Peter Brotherhood for an engine to drive one of their dynamos in connection with the above.

**Birmingham.**—Hadfields Steel Company have secured the order for the steel points and crossings required in the layouts and special work of the Birmingham new tramway system. They are to be of that firm's "Era" manganese quality, and represent a very substantial amount of work.

**Derwent Valley.**—The cast iron pipes required for the Derwent aqueduct south of Ambergate have been divided between the Sheepbridge Coal and Iron Company (Limited), and the Stavely Coal and Iron Company (Limited), the close proximity of these firms to the work to be executed enabling them to cut out competitors.

## APPOINTMENTS VACANT.

Last Day.

**Swindon.**—Assistant lecturer at the Swindon and North Wilts Secondary School and Technical Institution. Mr. W. Seaton, Secretary, Education Office, Town Hall, Swindon ... ... ... ... ... April 29

**India.**—Twenty-five appointments of Assistant Engineer in the permanent establishment of the Indian Public Works Department, in addition to the appointments to ments to be made from Coopers Hill College. Secretary, Public Department, India Office ... ... ... ... ... May 1

**Newport.**—Engineer for lunatic asylum at a salary of £130. Medical Superintendent, County Borough Asylum, Newport (Mon.) April 15

## APPOINTMENTS FILLED.

**North British Railway.**—The Earl of Dalkeith has been appointed chairman of the North British Railway Company to fill the vacancy caused by the death of Mr. G. B. Wieland.

**Bermondsey.**—The Borough Council has elected as chief electrical engineer, Mr. W. E. G. Heenan, late borough electrical engineer and tramway manager, Southend-on-Sea.

**Port Talbot Railway and Docks Co.**—In consequence of the resignation of Mr. W. J. Hosgood, resident engineer and locomotive superintendent, the following appointments have been made. Mr. W. Cleaver to be engineer, and Mr. H. Hertz to be locomotive superintendent.

**Leeds.**—The choice of the Leeds City Council of an engineer for the waterworks at a salary of £1,000 a year has, upon the recommendation of the Waterworks Committee, fallen upon Mr. Charles George Henry Hensall, of Newcastle-on-Tyne, who has had large experience in the management of waterworks.

**Hereford.**—Mr. S. C. F. Mitchell, of Hampton Wick, recently in the employ of Messrs. Christian and Phipps, has been appointed resident electrician at the Burghill County and City Asylum, near Hereford.

# Share List of Engineering, Electrical, Iron and Steel, and other Companies.

**The following is a comprehensive list of Companies in the industries covered by "Page's Weekly," in which shares business is being currently transacted. Additions will be made from time to time as occasion requires. We desire it to be understood that while our Share List will generally be found correct, we do not hold ourselves responsible for any loss or inconvenience that may arise from possible inaccuracies.**

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STOCK EXCHANGE SETTLING DAYS.—Settling days on the Stock Exchange are as follows:—

Consols: May 4th, June 1st. General Settlements: April 28th, May 12th. Bank Rate, March 9th, 1905, 2½ per cent

## I.—ENGINEERING, IRON, AND STEEL COMPANIES.

| Present Amount Subscribed. | Shares. | Last Dividend. | Name. | Paid up. | Closing Prices. |
|---|---|---|---|---|---|
| 11,370 | 5 | 5% | Alldays & Onions Pneumatic Engineering, Ltd. .. .. .. | 3 | 2¾— 3* |
| 10,000 | 5 | 3/- | Do. Cum. Pref. 6 per cent. .. | 5 | 4⅝— 4⅞* |
| 3,210,000 | 1 | 1/- | Armstrong (Sir W. G.), Whitworth and Co., Ltd. | 1 | 3¼ — 3⅜* |
| 76,970 | 5 | 2/- | Do. 4% Cum. Pref.. .. | 5 | 5½— 5¾* |
| 1,500,000 | 100 | 4% | Do. 4% 1st Mort. Dbs. Rd. | 100 | 101 —103 |
| £100,000 | 100 | 4½% | Aveling and Porter, Ltd., 4½% Reg. Mt. Debs. Red. .. .. | 100 | 96 — 99 |
| 530,000 | 1 | 1/7⅕ | Babcock and Wilcox, Ltd., Ord. .. | 1 | 4⅞— 5⅛ |
| 100,000 | 1 | 7⅕d. | Do. ,, 6% Cum. Pref. | 1 | 1½— 1⅝ |
| 20,000 | 5 | 3/- | Baker (Joseph) and Sons, Ltd., 6% Cum. Pref. .. .. .. .. | 5 | 4¾— 5¼* |
| 250,000 | 1 | 6⅗d. | Baldwins, Ltd., 5½% Cum. Pref. .. | 1 | 1 — 1⅛ |
| £250,000 | Stk | 4½% | Do. 1st Mt. 4½% Deb. Stk. Red. | 100 | 101 —103 |
| 150,000 | 4½ | 2/8⅖ | Barrow Hæmatite Steel Co., Ld., O. | 4½ | 1⅜ — 1⅝ |
| 50,000 | 4½ | 6/- | Do. do. Cum 2nd. Pref. | 4½ | 4¼— 4½ |
| 33,334 | 5 | 2/6 | Bayliss, Jones and Bayliss, Ltd., 5% Cum. Pref. Shares .. .. | 5 | 4¾— 5¼* |
| £500,000 | 100 | — | Beardmore (Wm.) & Co., Ltd., 4½% 1st Mt. Debs., Red., Scrip 50% pd | — | 103 —105 |
| 50,000 | 10 | 6/- | Bell Brothers, Ltd., 6% Cum. Pref. | 10 | 11¾— 12¼ |
| £366,600 | Stk | 4% | Do 4% Deb. Stock, Red. | 100 | 99 —101 |
| 200,000 | 1 | 1/- | Beyer, Peacock and Co., Ltd., Ord. | 1 | 7/16 — 9/16 |
| 300,000 | 1 | 6⅗d. | Do. 5½% Cum Pref. | 1 | ¾ — ⅞ |
| £300,000 | Stk | 4¼% | Do. 4¼% Red. Deb. Stock | 100 | 96 — 99 |
| 1,629,760 | 1 | 6d. | Bolckow, Vaughan and Co., Ltd., O. Nos. 1-1,629,760 | 1 | 1 —1 1/16 |
| 1,860,900 | 1 | 3⅗d. | Do. Nos. 1,639,101-3,500,000 | 12/- | 17/32— 19/32 |
| 1,160,000 | 1 | 4½d. | Brown (John) and Co., Lim., Ord., Nos. 1-1,160,000 | 15/- | 1 3/16— 1 5/16 |
| 590,000 | 1 | 6d. | Do. Ord., Nos. 1,160,001-1,750,000 | 1 | 1 25/32— 1 27/32 |
| 74,000 | 10 | 5/- | Do. 5 % Cum. Pref. .. ... | 10 | 11¼— 11¾ |
| 154,500 | 5 | 5/- | Cammell, Laird & Co., Ltd., Ord. .. | 5 | 8¾— 9¼* |
| 232,500 | 5 | 2/6 | Do. 5% Cum. Pref. .. | 5 | 5⅛ — 5¼* |
| 450,000 | 1 | 1/6 | Clayton & Shuttleworth, Ltd., Ord. | 1 | 1 1/32—1 3/32 |
| 70,000 | 5 | 2/6 | Do. 5% Cum. Pref. .. .. | 5 | 5½— 5¾ |
| £250,000 | Stk | 4% | Do 4% 1st Mort. Db. Stk. Red | 100 | 100 —102 |
| 100,000 | 10 | 7/6 | Consett Iron Co., Ltd., Ord.. .. | 7½ | 32— 33 |
| 57 031 | 10 | 10/- | Crossley, Bros., Ld , Ord. 40340/97370 | 10 | 16 —16½ |
| 40,339 | 10 | 5% | Do. 5% Cum. Pref. .. .. | 10 | 11¾—12 |
| 75,000 | 1 | 2/6 | Delta Metal, Ltd. Shares .. .. | 1 | 2 — 2¼ |
| 1,259,594 | 1 | 3⅗d. | Dorman, Long & Co., Ltd. .. .. | 1 | ⅝— 11/16 |
| £400,000 | Stk | 4% | Do. 4% 1st Mort. Perp. Deb. Stk. | 100 | 91 — 94 |
| 200,000 | 5 | 3/- | Dunderland Iron Ore Co., Ltd., 6% Cum. Pref. and Participating.. | 5 | 3⅜— 3⅝ |
| 250,000 | 1 | 9⅗d. | Dunlop (James) & Co., Ltd., Ord... | 1 | ½— ⅝ |
| 300,000 | 1 | 7⅕d. | Do. 6% Cum. Pref. .. | 1 | ⅞ - 15/16 |
| 4,721 | 13 | 12/- | Ebbw Vale Steel, Iron & Coal Co., Ltd. | 13 | 9½— 10½ |
| 69,754 | 13 | 12/- | Do. do. do. | 10 | 7⅜— 7⅞ |
| 20,250 | 10 | 8/- | Elliott's Metal, Ltd. .. .. | 8 | 4½— 5½ |
| 5,000 | 10 | 5% | Do. Cum. Pref. 5% .. .. | 10 | 8¾— 9¼ |
| 186,748 | Stk | 4% | Do. Deb. 4% .. .. | 100 | 94½ — 96½ |
| 25,000 | 10 | 6/- | Fairfield Shipbuilding & Engng. Co., Ltd., 6% Cum. Pref. .. | 10 | 10¾— 11¼ |
| £250,000 | Stk | 4½% | Do. 4½% Mort. Deb. Stk. Red. | 100 | 100 —103 |
| 9,000 | 10 | 10% | Fleming & Ferguson, Ltd. Ord. Nos. 1/9000.. .. .. .. .. | 10 | 12 —12¼* |
| 6,000 | 10 | 5% | Do. 5% Cum. Pref. Nos. 9001/15000 | 10 | 9½—10 |
| 126,000 | 3 | 3/- | Fraser & Chalmers, Ltd., Ord. .. | 3 | 4⅝— 4⅞ |
| 21,000 | 3 | 1/6 | Do. 7½% Cum. Pref. | 3 | 5¾— 6¼ |
| 10,000 | 10 | 5% | Galloways, Ltd., 5% Cum. Pref. 18001/28000 .. .. | 10 | 6 — 7 |
| £150,000 | Stk | 4% | Do. 4% 1st Mort. Deb Red.. | 100 | 90½—91½ |
| 16,800 | 10 | — | Greenwood & Batley, Ltd., Ord. .. | 10 | 4¼— 4½ |
| 9,600 | 10 | 7% | Do. 7% Cum. Pref. .. .. | 10 | 10¼— 10¾ |
| 965,000 | 1 | 1/- | Guest, Keen & Nettlefolds, Ltd. Ord. | 1 | 2¼ — 2⅜ |
| 341,000 | 5 | 2/6 | Do. 5% Cum. Pref. .. .. | 5 | 5⅞— 6⅛ |
| £1,850,500 | Stk | 4% | Do. 4% Irred. Mort. Deb. Stk | 100 | 106 —108 |
| 18,000 | 5 | 2/6 | Gwynnes, Ltd., 5% Cum. Pref. .. | 5 | 2 — 3 |
| 250,000 | 1 | 3/6 | Hadfield's Steel F'dry Co., Ld., Ord. | 1 | 3⅛— 3¼ |
| 20,000 | 10 | 4/6 | Do. 4½% Cum. Pref. .. .. | 10 | 10¾— 11¼ |
| 80,000 | 5 | 3/- | Hall (J. & E.), Ltd. 6% Cum. Pref... | 5 | 5 — 5½ |
| 408,505 | 1 | 1/6 | Harvey United Steel Co., Ltd. .. | 1 | 1¼ — 1⅜ |
| 47,500 | 10 | 7½% | Hawthorn, Leslie & Co., Ltd. Ord. | 10 | 10¾— 11 |
| 28,001 | 5 | 7/- | Head, Wrightson & Co., Ltd. .. | 5 | 5 — 5½ |
| 85,000 | 1 | 7⅕d. | Hill (Richard) & Co. (1899) Ld., Ord. | 1 | 11/16— 13/16 |
| 18,000 | 5 | 3/- | Do. 6% Cum. Pref. .. .. | 5 | 4¾— 5 |
| 30,000 | 10 | 6/- | Hornsby (Richard) & Sons, Ld., Ord. | 8 | 5½— 6 |

## ENGINEERING, IRON, AND STEEL COMPANIES.—*Contd.*

| Present Amount Subscribed. | Shares. | Last Dividend. | Name. | Paid up. | Closing Prices |
|---|---|---|---|---|---|
| 750,000 | 1 | 6d. | Howard & Bullough, Ltd., Ord. .. | 1 | 1⅝— 1¾ |
| 25,000 | 10 | 6/- | Do. 6% Pref. (Non-Cum.) .. | 10 | 13 — 13½ |
| £250,000 | Stk | 4% | Do. 4% Deb. Stk., Red. after 1905 | 100 | 98 —101 |
| 37,500 | 10 | 20 | Kynoch, Ltd. .. .. .. .. | 10 | 18½— 19½ |
| 49,537 | 10 | 5% | Do. Cum. Pref. 5% .. .. | 10 | 10¾— 11 |
| 300,000 | 1 | 4⅘d. | Lambert Bros., Ltd., Ord. .. .. | 1 | ⅞— 1 |
| 50,000 | 5 | 2/9 | Do. 5½% Cum. Pref. .. .. | 5 | 4¼— 4¾ |
| 40,000 | 3 | 2/1⅕ | Leeds Forge Co., 7% Cum. Pref. .. | 3 | 3¾— 4¼ |
| 200,000 | 1 | 7⅕d. | Lysaght (John), Ltd., 6% Cum. Pf. | 1 | 1 5/16— 1 7/16 |
| £300,000 | Stk | 4½% | Do 4½% 1st Mt. Deb. Stk., Red. | 100 | 109 —111 |
| 40,000 | 10 | 5/- | Mather & Platt, Ld., 5% Cum. Pref | 10 | 11 —11½ |
| 210,000 | 1 | 8⅖d. | Measures Bros., Ltd., Ord. .. .. | 1 | ⅝— ¾ |
| 75,000 | 1 | 6⅗d. | Do. 5½% Cum. Pref. .. .. | 1 | 13/16— 15/16* |
| £75,000 | Stk | 4½% | Do. 4½% 1st Mrt. Db. Stk., Red. | 100 | 92 — 95* |
| 21,943 | 5 | 2/6 | Muntz Metal, Ltd. .. .. | 5 | 5¼— 5½ |
| 14,248 | 5 | 5% | Do. Pref. 5% .. .. .. | 5 | 4¾— 5¼ |
| 5,000 | 62½ | 47/6 | Nantyglo and Blaina Iron Works, Ltd., 8% Cum. Pref. | 62½ | 79 — 82 |
| 73,000 | 10 | 5/- | N. Brit. Loco. Co., Ltd., 5% Cm. Pf. | 10 | 12 —12¼ |
| 80,000 | 5 | — | North-Eastern Steel Co., Ltd., Ord. | 5 | — |
| £250,000 | Stk | 4½% | Do. 4½% 1st Mrt. Db. Stk., Red. | 100 | 90 — 93 |
| 122,000 | 5 | 1/6 | Pearson & Knowles Coal and Iron Co., Ltd., Ord., "B" | 5 | 3⅞— 4⅛* |
| 50,000 | 5 | 3/- | Do. 6% Cum. Pref. "A" .. | 5 | 5⅞— 6¼* |
| 70,000 | 10 | 6/- | Pease & Partners, Ltd., Ord. .. | 10 | 9¾— 10¼ |
| £400,000 | Stk | 4% | Do. 4% Perp. Deb. Stock | 100 | 99 —102 |
| 20,000 | 5 | 3/- | Peebles (Bruce) & Co., Ld., 6% Cm. P. | 5 | 4⅞— 5⅛* |
| 65,000 | 1 | — | Pooley (Henry) & Son., Ltd., Ord .. | 1 | 6/- — 6/6 |
| 13,000 | 5 | — | Do. 5½% Cum. Pref. .. .. | 5 | 4⅜— 4½ |
| 230,000 | 1 | — | Projectile Co. (1902), Ltd., Ord. .. | 1 | ⅜— ½ |
| 126,938 | 5 | 2/- | Rhymney Iron Co., Ltd. .. .. | 5 | 1⅞— 2 |
| 73,062 | 5 | 2/- | Do. New .. .. .. | 5 | 1½— 1¾ |
| £330,000 | — | 5% | Do. 5% Mort. Deb., Red. .. | 100 | 101 —103 |
| 350,000 | 1 | 7⅕d. | Richardsons, Westgarth & Co., Ltd., 6% Cum. Pf. .. | 1 | ⅞— 15/16 |
| £350,000 | Stk | 4½% | Do. 4½% Perp. Deb. Stock .. | 100 | 94 — 96 |
| 35,000 | 10 | 12/- | Ruston, Proctor & Co., Ltd.. .. | 10 | 9½— 10 |
| 275.000 | 1 | 6d. | Scott (Walter), Ltd., Ord. .. | 1 | 13/16— 15/16 |
| 300,000 | 1 | 7⅕d. | Do. 6% Cum. Pref. .. | 1 | 1— 1⅛ |
| £300,000 | Stk | 4% | Do. 4% Perp. Deb. Stk. | 100 | 94 — 96 |
| £115,300 | 100 | 5% | Shelton Iron, Steel and Coal Co., Ld. 1st Charge 5% Debs.. Red .. | 100 | 92 — 95 |
| £97,900 | 100 | 6% | Do. 6% 2nd Mort. Debs., Red. | 100 | 91 — 95 |
| 250,000 | 1 | 1/- | South Durham Steel & Iron, Ltd. Or. | 1 | 21/32— 23/32 |
| 300,000 | 1 | 1/2⅖ | Do. 6% Cum. Pref... | 1 | 27/32 — 29/32 |
| £300,000 | Stk | 4½% | Do. 4½% Per. Deb. Stock | 100 | 89 — 92 |
| 49,560 | 10 | 2½% | Steel Co. of Scotland Ord. 1/49560.. | 9 | 5¼— 5⅝ |
| £125,240 | Stk. | 5% | Do. 5% Trust Mort. Deb. .. | 100 | 106½—107½ |
| 25,000 | 10 | — | Stephenson (Robert) & Co., Ltd., Or. | 10 | 2¼— 2¾ |
| 25,000 | 10 | 5/6 | Do. 5½% Cum. Pref. .. | 10 | 4¼— 4¾ |
| £250,000 | Stk | 4% | Do. 4% Perp. Deb. Stock | 100 | 78— 81 |
| 85,000 | 10 | 9/- | Stewarts & Lloyds, Ltd., Ord. .. | 10 | 18 — 18½ |
| 55,000 | 10 | 6/- | Do. 6% Cum. Pref. .. .. | 10 | 14¾— 15¼ |
| 634,732 | 1 | 6d. | Swan, Hunter & Wigham-Richardson, Lim. Ord. | 1 | ¾— ⅞ |
| 538,845 | 1 | 6d. | Do. 5% Cum. Pref. .. | 1 | ⅞ — 1 |
| £240,000 | Stk | 4½% | Do. 4½% 1st Mort. Deb. Stk. Red | 100 | 98 — 101 |
| 300,000 | 1 | 6d. | Thames Iron Works, Shipbuilding & Engineering Co., Ltd., 5% Cum. Pf. | 1 | 9/16— 11/16 |
| £200,000 | 100 | 4% | Do. 4% Irredeem. 1st Mort. Deb. | 100 | 74 — 79 |
| £160,000 | 1 | 7⅕d. | Thornycroft (John I.) & Co., Ltd. 6% Cum. Pref. | 1 | 15/16— 1 1/16 |
| 10,000 | 10 | 5/- | Tylor (J.) & Sons, Ltd. 5% Cum. Pf. | 10 | 9½— 10 |
| $508495200 | $100 | $½ | United States Steel Corp. Com. Stk. | $100 | 38⅛— 38⅜ |
| $360814100 | $100 | $1¾ | Do. 7% Cum. Pref. Stock | $100 | 104½— 105 |
| $162268000 | $1000 | 5% | Do. 10-60yr. 5% Skg. Fd. G. Bds. | $1000 | 99 — 101 |
| 3,350,000 | 1 | 1/6 | Vickers, Sons & Maxim, Ltd. Ord.. | 1 | 2⅜— 2½ |
| 750,000 | 1 | 6d. | Do. 5% Non-Cum. Pref. .. | 1 | 1 3/16 —1 5/16 |
| £750,000 | Stk | 5% | Do. 5% Non-Cum. Pref. Stock. | 100 | 117 —120 |
| £1,250,000 | Stk | 4% | Do. 4% 1st. Mort. Deb. Stk. Red. | 100 | 107 —109 |
| £1,000,000 | 100 | 4½% | Do. 4½% 2nd Mort. Debs., Red. | 100 | 106 —108 |
| 225,000 | 1 | 1/2⅖ | Weardale Steel, Coal & Coke, Ltd., Def. Ord. | 1 | ¾— ⅞ |
| 500,000 | 1 | 7⅕d. | Do. 6% Cum. Pref. Ord. .. | 1 | ⅞— 1 |
| £300,000 | Stk | 4% | Do. 4% Perpetual Deb. Stock | 100 | 84 — 88 |
| 7,637 | 5 | 2/9 | Weldless Steel Tube, Ltd., Cum. Pref. 5½ | 5 | 4⅝— 4⅞ |
| 300 | Stk | 4½% | Do. Mort. Deb. 4½% .. .. | 100 | 92 — 98 |
| 66,666 | 5 | 3/. | Willans & Robinson, Ord. .. .. | 5 | 1 — 2 |
| 66,666 | 5 | 3/- | Do. 6% Cum. Pref. .. .. | 5 | 2 — 3 |
| £246,641 | Stk | 4% | Do. 4% 1st Mort. Deb. Stk. Red | 100 | 75 — 80 |
| £150,000 | Stk | 4½% | Yorkshire Iron & Coal Co., Ltd., 4½% 1st Mort. Deb. Stk. Red. | 100 | 81 — 86 |

Stocks and Shares marked * are quoted ex-dividend.

## II.—ELECTRICAL MANUFACTURING COMPANIES.

| Present Amount Subscribed. | Shares. | Last Dividend. | Name | Paid up. | Closing Prices. |
|---|---|---|---|---|---|
| 70,000 | 1 | 6d. | Alliance Elec. Co., Ltd. 5% Cum. Pf. | 1 | ⅝—⅞ |
| 125,000 | 1 | 7½d. | Aron Elec. Meter Ltd., 6% Cum. Pf. | 1 | $\frac{7}{16}$—$\frac{9}{16}$ |
| 120,000 | 1 | 1/2⅖ | Bell's Asbestos Co., Ltd. .. .. | 1 | ¾—⅞* |
| 100,000 | 5 | 4/- | British Insulated & Helsby Cables Ltd., Ord. .. | 5 | 5½—6* |
| 100,000 | 5 | 3/- | Do. 6% Cum. Pref. .. .. | 5 | 5½—6 |
| £500,000 | Stk | 4½% | Do. 4½% 1st Mort. Deb. Stk. Rd. | 100 | 101—104 |
| £200,000 | Stk | 4½% | British Thomson-Houston Co., Ltd., 4½% 1st Mort. Deb. Stk. Red. .. | 100 | 99—101 |
| 400,000 | 5 | 3/- | British Westinghouse Electric and Manufac. Co., Ltd., 6% Pref. .. | 5 | 2⅞—3⅛ |
| £616,353 | Stk | 4% | Do. 4% Mort. Deb. Stk. Red... | 100 | 91—93 |
| 105,731 | 2 | 2/- | Brush Elec. Enging. Co., Ltd., Ord.. | 2 | ½—¾ |
| 150,000 | 2 | 2/4⅘ | Do. 6% Pref. .. .. .. | 2 | 1½—2 |
| £125,000 | Stk | 4½% | Do. 4½% Perp. 1st Deb. Stk... | 100 | 92—95 |
| £125,000 | Stk | 4½% | Do. 4½% Perp. 2nd Deb. Stk. | 100 | 79—82 |
| 35,000 | 5 | 5/- | Callender's Cable & Constn. Ltd. Ord. | 5 | 11—11½ |
| 40,000 | 5 | 2/6 | Do. 5% Cum. Pref. .. .. | 5 | 5½—5¾ |
| £200,000 | Stk | 4½% | Do. 4½% 1st Mort. Deb. Stk. Red. | 100 | 107—109 |
| 85,000 | 3 | 1/6 | Crompton & Co., Ltd... .. .. | 3 | 2⅛—2⅜ |
| £100,000 | — | 5% | Do. 5% 1st Mort. Reg. Debs. | 100 | 93—98 |
| 52,000 | 5 | 10/- | Dick, Kerr & Co., Ltd., Ord. .. | 5 | 7½—8 |
| 161,000 | 5 | 3/- | Do. 6% Cum. Pref. .. .. | 5 | 5¾—6* |
| £300 000 | Stk | 4½% | Do. 4½% Deb. Stock, Red. .. | 100 | 105—107 |
| 233,334 | 1 | 6d. | Doulton & Co., Ltd., 5% Cum. Pref. | 1 | 1⅛—1⅜ |
| £233,334 | Stk | 4% | Do. 1st Mort. 4% free. Deb. Stk. | 100 | 106—109 |
| 99,261 | 5 | 1/6 | Edison and Swan United Electric Light, Ltd., "A" Shares Nos. 1-99,261 .. .. | 3 | 1—1¼ |
| 17,139 | 5 | 2/6 | Do. "A" Shares Nos. 01-017,139 | 5 | 1¾—2¼ |
| £344,023 | Stk | 4% | Do. 4% Deb. Stock Red. .. | 100 | 80—85 |
| £100,000 | Stk | 5% | Do. 5% Second Deb. Stk. Red. | 100 | 84—89* |
| 112,100 | 2 | 1/7⅕ | Electric Construction Co., Ltd. .. | 2 | 1⅛—1¼ |
| 31,390 | 2 | 2/9⅗ | Do. 7% Cumulative Pref. .. | 2 | 2¼—2½ |
| £200,000 | Stk | 4% | Do. 4% Perp. 1st Mt. Deb. Stk. | 100 | 97—99 |
| 10,248 | 10 | 7/6 | Evered and Co., Ltd. .. .. | 10 | 12—14 |
| £100,000 | Stk | 5% | Ferranti, Ltd., 5% 1st Mort. Deb. Stock, Red... .. .. | 100 | 90—95 |
| 25,000 | 10 | 5/- | Gen. Elect. Co. (1900), Ltd., 5% Cum. Pref. | 10 | 9½—10 |
| £200,000 | Stk | 4% | Do. 4% 1st. Mt. Deb. Stk., Red. | 100 | 97—101* |
| 35,000 | 5 | 10/- | Henley's (W. T.) Telegraph Works Co., Ltd., Ord. | 5 | 11¾—12½ |
| 35,000 | 5 | 2/3 | Do. 4½% Cum. Pref. .. .. | 5 | 5⅜—5⅝ |
| £50 000 | Stk | 4½% | Do. 4½% Mt. Deb. Stk. Red. | 100 | 109—111 |
| 50,000 | 10 | 5/- | India Rubber, Gutta Percha & Telegraph Works Co., Ltd., | 10 | 16—17 |
| £300,000 | 100 | 4% | Do. 1st Mort. Deb. Red. .. | 100 | 100—103* |
| 7,500 | 10 | — | Parker, Thos., Ltd. .. .. | 10 | 6½—7 |
| 100,000 | 1 | 3% | Scott (Ernest) & Mountain, Ld., Ord. | 1 | 16/3—16/9 |
| 37,350 | 12 | 24/- | Telegraph Construction and Maintenance Co., Ltd. | 12 | 36—38 |
| £150,000 | 100 | 4% | Do. 4% Deb. Bonds .. .. | 100 | 103—105 |

## III.—ELECTRIC TRACTION.

| Present Amount Subscribed. | Shares. | Last Dividend. | Name. | Paid up. | Closing Prices. |
|---|---|---|---|---|---|
| 120,000 | 5 | 3/- | Anglo-Argentine Trams Co., Ld., Or. | 5 | 8⅝—8⅞ |
| 260,007 | 5 | 2/6 | Do. 5% Cum Pf. | 5 | 5¾—6 |
| £230,000 | Stk | 6% | Do. Permanent 6% Debenture Stock, 1888 .. | 100 | 140—143 |
| 20,000 | 10 | 6/- | Barcelona Trams Co., Ltd., Ord. .. | 10 | 12—12½ |
| 10,000 | 10 | 5/- | Do. 5% Cum Pf. Shares | 10 | 9—10 |
| £46,300 | 100 | 5% | Do. 5% Debs., Red. .. | 100 | 99—102 |
| £191,326 | Stk | 4½% | Do. 4½% Red. Deb. Stk. | 100 | 96—100 |
| 75,606 | 1 | — | Bath Elec. Trams. Ld., Pf. Or. .. | 1 | $\frac{13}{16}$—$\frac{15}{16}$ |
| 59,394 | 1 | 11·49d | Do. 5% Cum. Pf. .. | 1 | $\frac{13}{16}$—1$\frac{1}{16}$ |
| 75,000 | 5 | — | Brisbane Electric Tram Investment Co., Ltd., Ord. .. .. | 5 | 1—1½ |
| 75,000 | 5 | 2/6 | Do. 5% Cum. Pf. .. | 5 | 3¾—4¼ |
| £425,000 | Stk | 4½% | Do. 4½% 1st Deb. Stk., Red. | 100 | 94—98 |
| £200,000 | Stk | 6% | Brit. Columbia Elec. Rly. Co., Ltd., Def. Ord. Stock .. .. | 100 | 104—107 |
|  |  | % | Pref. Ord. Stock .. .. | 100 | 100—103 |
| 133,301 | 10 | 6/- | Brit. Electric Traction, Ltd., Ord. | 10 | 9—9¼ |
| 156,437 | 10 | 6/- | Do. 6% Cum. Pref. .. .. | 10 | 10¾—11¼ |
| £1,000,000 | Stk | 5% | Do. 5% Perp. Deb. Stk. .. | 100 | 120—122* |
| £250,000 | Stk | 4½% | Do. 4% 2nd Deb. Stk. Red.. | 100 | 98—100 |
| 100,000 | 5 | 1/6 | Buenos Ayres & Belgrano Electric Trams, Ltd., Ord. | 5 | 3¾—4 |
| 40,500 | 5 | 3/- | Do. "A" 6% Cum Pref. .. | 5 | 5⅝—5⅞ |
| 27,000 | 5 | 3/- | Do. "B" do. | 5 | 5⅜—5⅝ |

### ELECTRIC TRACTION.—*Contd.*

| Present Amount Subscribed. | Shares. | Last Dividend. | Name. | Paid up. | Closing Prices. |
|---|---|---|---|---|---|
| £200,000 | Stk | 5% | Buenos Ayres Elec. Trams Co. (1901) Ltd., 5% Db. Stk., Red. | 100 | 97—99 |
| £220,000 | 100 | 6% | Buenos Ayres Gd. Nat., Ltd., 6% 1st Deb. Bds. | 100 | 101—105* |
| 102,268 | 5 | 3/- | Calcutta Tramways Co., Ltd. .. | 5 | 8½—8¾ |
| £350,000 | Stk | 4½% | Do. 4½% 1st Deb. Stk., Red. | 100 | 106—10 |
| 480,000 | 1 | 6d. | Cape Electric Tramways, Ltd. .. | 1 | 1⅜—1⅝ |
| 40,000 | 5 | 2/6 | City of Birmingham Trams Co., Ltd. 5% Cum. Pref. | 5 | 4⅞—5⅛ |
| £300,000 | 100 | 4% | Do. 4% 1st Mort. Debs. .. | 100 | 101—104 |
| £120,000 | Stk | 5% | Colombo Elec. Tram. & Light. Co., Ltd., 5% 1st Mort. Deb. Stk. Red. | 100 | 103—105 |
| 60,000 | 10 | 6/- | Dublin United Trams. Co. (1896), Ltd., Ord. .. | 10 | 13½—14½ |
| 59,987 | 10 | 6/- | Do. 6% Pref... .. .. | 10 | 15½—16½ |
| 30,000 | 5 | 2/6 | Isle of Thanet Elec. Trams. and Light. Co., Ltd., 5% Cum. Pref. | 5 | 2½—3¼ |
| £150,000 | Stk | 4% | Do. 4% Deb. Stock.. .. | 100 | 85—90 |
| 125.000 | 10 | 5/- | London United Trams. (1901), Ltd., 5% Cum. Pref. .. .. | 10 | 10—10½ |
| £1.031,000 | Stk | 4% | Do. 4% 1st Mort. Deb. Stk. Red. | 100 | 99—102 |
| £50,000 | Stk | 5% | Madras Electric Trams (1904), Ltd., 5% Deb. Stock, Red. .. .. | 100 | 101—103 |
| 314,016 | 1 | — | Metropolitan Elec. Trams, Ltd., Def. | 1 | $\frac{13}{32}$—$\frac{15}{32}$ |
| 500,000 | 1 | 6d. | Do. 5% Cum. Pref... .. | 1 | 1—1$\frac{1}{16}$ |
| £350,000 | Stk | 4½% | Do. 4½% Deb. Stock, Red. | 100 | 105—107 |
| 50,000 | 5 | 6/- | New General Traction Co., Ltd., 6% Cum. Pref. .. .. .. | 5 | ½—1½ |
| 110,923 | 8 | 3/2⅖ | North Metropolitan Tramways Co.. | 8 | 4—4½ |
| £150,000 | 100 | 3½% | Do. 3½% Mort. Debs. | 100 | 90—95 |
| £196,200 | Stk | 5% | Perth Electric Trams, Ltd. (W.A.) 5% 1st Mort. Deb. Stock, Red.. | 100 | 105—108 |
| 24,500 | 10 | 10/- | Potteries Elec. Traction Co., Ld., Or. | 10 | 9½—10 |
| 24,500 | 10 | 5/- | Do. 5% Cum. Pref. .. | 10 | 9½—10 |
| £220,000 | Stk | 4½% | Do. 4½% Deb. Stk., Red. | 100 | 103—107 |

## IV.—ELECTRIC LIGHTING AND POWER.

| Present Amount Subscribed. | Shares. | Last Dividend. | Name. | Paid up. | Closing Prices. |
|---|---|---|---|---|---|
| 7,500 | 10 | 14/- | Bournemouth & Poole Elec. Sup. Co., Ltd., Ord. .. | 10 | 11¾—12¼* |
| 7,500 | 10 | 4/6 | Do. 4½% Cum. Pref. .. | 10 | 9¾—10¼ |
| 7,500 | 10 | 6/- | Do. 6% Cum. Second Pf. .. | 10 | 11—12 |
| £70,000 | Stk | 4½% | Do. 4½% Deb. Stock Red .. | 100 | 105—107 |
| 14,000 | 5 | 2/- | Bromley (Kent) Elec. Lt. & Pr. Co. Ld | 5 | 5¼—5¾ |
| £50,000 | Stk | 4½% | Do. do. 4½% 1st Deb. Stk. Red. | 100 | 103—106 |
| 27,507 | 5 | 5/6 | Brompton & Kensington Elec. Supply Co., Ltd. Ord. .. | 5 | 9½—10½* |
| 12,493 | 5 | 3/6 | Do. 7% Cum. Pref. Shares.. | 5 | 9½—10½* |
| 60,000 | 5 | 3/- | Calcutta Elec. Sup. Cor. Ltd., Ord.. | 5 | 9—9¼ |
| £288,782 | Stk | 4% | Central Elec. Sup. Co., Ltd., 4% Gua. Deb. Stk. .. | 100 | 105—108 |
| 70,000 | 5 | 4/- | Charing Cross & Strand Elec. Sup. Corp., Ltd., Ord... .. | 5 | 7½—8½ |
| 80,000 | 5 | 2/3 | Do. do. 4½% Cum. Pref... | 5 | 5⅜—5⅝ |
| £350,000 | Stk | 4% | Do. do. 4% Deb. Stk. Red. | 100 | 105—107 |
| 41,436 | 5 | 3/9 | Chelsea Elec. Sply. Co., Ltd., Ord. | 5 | 6½—7 |
| £150,000 | Stk | 4½% | Do. do. 4½% Deb. Stk., Red | 100 | 109—111 |
| 70,595 | 10 | 7/- | City of London El. Lghtg. Co., Ld., O. | 10 | 11½—12 |
| 40,000 | 10 | 6/- | Do. 6% Cum. Pref. .. .. | 10 | 13½—14 |
| £400,000 | Stk | 5% | Do. 5% Deb. Stk., Red .. | 100 | 123—127 |
| £300,000 | Stk | 4½% | Do. 4½% 2nd Deb. Stk., Red | 100 | 103—105 |
| 40,000 | 10 | 5/- | County of London Elec. Supply Co., Ltd., Ord. | 10 | 9—9½* |
| 30,000 | 10 | 6/- | Do. 6% Cum. Pref. .. .. | 10 | 12—12½* |
| £400,000 | Stk | 4½% | Do. 4½% Deb. Stk., Red. .. | 100 | 110—113 |
| 70,000 | 5 | 2/6 | Edmundson's Elec. Cor. Ltd., Ord. | 5 | 6—6¼ |
| 70,000 | 5 | 3/- | Do. 6% Cum. Pref. .. .. | 5 | 6⅛—6⅜ |
| £300,000 | Stk | 4½% | Do. 4½% 1st Mort. Db. Stk. Reg | 100 | 106—108 |
| £80,000 | Stk | 5% | Electric Lighting & Traction Co. of Australia, Ltd. 5% Deb. Stk. Red. | 100 | 86—91 |
| 10,000 | 5 | 2/- | Folkestone Elec. Supply Co., Ld., O. | 5 | 5½—6 |
| £50,000 | Stk. | 4½% | Do. 4½% 1st Deb. Stk., Red. | 100 | 101—104 |
| 15,000 | 10 | — | Havana Electricity Co., Ltd... .. | 10 | 9½—10½ |
| 13,000 | 5 | 3/6 | Hove Elec. Lighting Co., Ltd., Ord. | 5 | 7¾—8¼ |
| £50,000 | Stk | 4½% | Isle of Wight Electric Light & Power Co., Ltd. 4½% Deb. Stock, Red. | 100 | 101—103 |
| 150,000 | 1 | — | Kalgoorlie Electric Power & Lighting Corp, Ltd., 6% Cum. Pref. | 1 | $\frac{11}{16}$—$\frac{13}{16}$ |
| 21,000 | 5 | 7/- | Kensington and Knightsbridge Electric Lighting Co., Ltd., Ord. .. | 5 | 12½—13 |

Stocks and Shares marked * are quoted ex-dividend.

## ELECTRIC LIGHTING AND POWER.—*Contd.*

| Present Amount bscribed. | Shares. | Last Dividend. | Name. | Paid up. | Closing Prices. |
|---|---|---|---|---|---|
| £135,000 | Stk | 4% | Kensington and Knightsbridge Electric Lighting Co., Ltd., and the Notting Hill Electric Lighting Co., Ltd., 4% Deb. Stock, Red. | 100 | 101 —103* |
| 111,000 | 8 | 1/9⅗ | London Elec. Supply Corp., Ld., Ord. | 8 | 2¼ — 2¾ |
| 60,000 | 5 | 3/- | Do. 6% Pref. .. .. .. | 5 | 5¼ — 5¾ |
| £371,895 | Stk | 4% | Do. 4% 1st Mort. Db. Stk., Red. | 100 | 99 —101 |
| 100,000 | 10 | 11/- | Metropolitan Elec. Sup. Co., Ld., Or. | 10 | 17½—18½ |
| 76,121 | 5 | 2/3 | Do. 4½% Cum. Pref. .. .. | 5 | 5⅝ — 5¾ |
| 220,000 | Stk | 4½% | Do. 4½% 1st Mort. Db. Sk., Red. | 100 | 110 —115 |
| 250,000 | Stk | 3½% | Do. 3½% Mort. Deb. Stk., Red. | 100 | 97 — 99 |
| £250,000 | — | 4½% | Midland Elec. Corp. for Power Distribution, Ld., 4½% 1st Mort. Deb. | 100 | 99 —101 |
| 10,852 | 10 | 8/- | Notting Hill Elec. Ltg. Co. Ltd. Ord. | 10 | 14½—15½ |
| £59,000 | 100 | 4% | Do. 4% 1st Mort. Debs. .. | 100 | 100 —102* |
| 16,500 | 5 | 4/6 | Oxford Electric Co. Ltd., Ord. .. | 5 | 6¼— 6½ |
| £50,000 | Stk | 4% | Do. 4% Debenture Stk. Red. | 100 | 98 —100 |
| £84,700 | 100 | 4½% | Royal Elec. Co. (of Montreal) 4½% 20-yr. 1st Mort. Deb | 100 | 98 —100* |
| 40,000 | 5 | 9/6 | St. James' & Pall Mall Elec. Light Co., Ltd. Ord. | 5 | 13½—14½ |
| 20,000 | 5 | 3/6 | Do. 7% Pref. .. .. | 5 | 8¼— 8¾ |
| £150,000 | Stk | 3½% | Do. 3½% Deben. Stock, Red | 100 | 98 —100 |
| 12,000 | 5 | 4/- | Smithfield Markets Elec. Supply Co., Ltd. Ord. | 5 | 2⅝— 3⅛ |
| £50,000 | Stk | 4% | Do. 4% Debenture Stk. Red. | 100 | 79 — 83 |
| 65,000 | 5 | 4/- | South London Elec. Sup. Co., Ltd, O. | 5 | 4 — 4¼ |
| 100,000 | 1 | — | South Metropolitan Elec Light & Power Co., Ltd. Ord. | 1 | ⅞ — 1 |
| 50,000 | 1 | 8⅖d. | Do. 7% Cum. Pref. .. .. | 1 | 1$\frac{5}{16}$—1$\frac{7}{16}$ |
| £100,000 | Stk | 4½% | Do. 4½% 1st Deb. Stock Red. | 100 | 105 —108* |
| 50,000 | 5 | 2/6 | Urban Electric Supply Co., Ltd., O. | 5 | 4$\frac{15}{16}$—5$\frac{1}{16}$* |
| 30,000 | 5 | 2/6 | Do. 5% Cum Pref. .. .. | 5* | 5⅛— 5¼* |
| £200,000 | Stk | 4½% | Do. 4½% 1st Mort. Deb. Stk. Red | 100 | 104—106* |
| 110,000 | 5 | 7/6 | Westminster Elec. Supply Corp. Ltd., Ord. | 5 | 12½—13 |
| 28,151 | 5 | 2/6 | Do. 5% Cum. Pref. .. .. | 5 | 6 — 6½ |

## V.—TELEGRAPH & TELEPHONE COMPANIES.

| Present Amount Subscribed. | Shares. | Last Dividend. | Name. | Paid up. | Closing Prices. |
|---|---|---|---|---|---|
| £34,800 | 100 | 4% | African Direct Tel. Co., Ld., 4% Mt. Debs. (Series A), Red. .. .. | 100 | 99 —102 |
| 25,000 | 10 | — | Amazon Telegraph Co., Ld... .. | 10 | 2¼ — 2¾ |
| £763,580 | Stk | 17/6 | Anglo-American Tel. Co., Ltd., Ord. | 100 | 61 — 63 |
| £3,118,210 | Stk | 35/- | Do. 6% Preferred Ordinary | 100 | 107 —108 |
| £3,118,210 | Stk | 2/- | Do. Deferred Ordinary .. | 100 | 15⅜—15⅞ |
| 44,000 | 5 | 3/- | Chili Telephone Co., Ltd. .. .. | 5 | 6⅝— 6⅞ |
| $15,000,000 | $100 | $2 | Commercial Cable Co., Capital Stk. | $100 | 230 —240 |
| £1,903,856 | Stk | 4% | Do. Sterl. 500-yr 4% Deb. Stk., Red. | 100 | 97 — 99* |
| 16,000 | 10 | 5/- | Cuba Submarine Tel. Co., Ld., Ord. | 10 | 8½— 9 |
| 6,000 | 10 | 10/- | Do. 10% Preference .. .. | 10 | 17 — 18 |
| 6,000 | 5 | 2/- | Direct Spanish Telegraph Co., Ord. | 5 | 3⅜— 3⅝* |
|  |  | 5/- | 10% Cum. Preference | 5 | 8½— 9* |
| £30,000 | 50 | 4½% | Do. 4½% Debs... .. .. | 50 | 101-103% |
| 60,710 | 20 | 3/- | Direct U.S. Cable Co., Ltd... .. | 20 | 11⅜—11⅝ |
| £85,800 | 100 | 4½% | Direct West India Cable Co., Ltd., 4½% Reg. Debs. | 100 | 100—102 |
| £300,000 | 100 | 4% | East. & S. African, Ld., 4% Mt. Dbs. | 100 | 100—102 |
| £200,000 | 25 | 4% | Do. 4% Rg. Mt. Dbs. (Mauritius Subsidy).. | 25 | 101-103% |
| 300,000 | 10 | 2/6 | Eastern Extension, Australasia and China, Ltd... | 10 | 14 — 14½ |
| £602,400 | Stk | 4% | Do. 4% Mort. Deb. Stk., Perp. | 100 | 105 —107 |
| £4,000,000 | Stk | 25/- | Eastern Tele. Co., Ltd., Ord. .. | 100 | 142 —145 |
| £2,000,000 | Stk | 17/6 | Do. 3½ % Pref. .. .. | 100 | 92 — 94 |
| £1,836,814 | Stk | 4% | Do. 4% Mort. Deb. .. .. | 100 | 108 —110 |
| 150,000 | 10 | 5/- | Great Northern Telegraph Co., Ltd., (of Copenhagen) .. | 10 | 37 — 39 |
| £58,700 | 100 | 4½% | Halifax and Bermudas Cable Co., Ltd., 4½% 1st. Mort. Debs. Red. | 100 | 100—102 |
| 17,000 | 25 | 12/6 | Indo-European Tele. Co., Ltd. .. | 25 | 51 — 53 |
| 72,680 | 1 | 7½d. | Monte Video Telephone Co., Ltd., O. | 1 | $\frac{13}{16}$— $\frac{15}{16}$ |
| £1,988,333 | Stk | 6% | National Telephone Co., Ltd., Pref. | 100 | 109 —110 |
| £1,966,667 | Stk | 5% | Do. Deferred .. .. .. | 100 | 101 —103 |
| 250,000 | 5 | 2/6 | Do. 5% Non-Cum. 3rd Pref. | 5 | 5½ — 5¾ |
| £2,000,000 | Stk | 3½% | Do. 3½% Deb. Stk., Red. .. | 100 | 100—102 |
| £689,593 | Stk | 4% | Do. 4% do. do. .. | 100 | 103½—105½ |
| 179,318 | 1 | 7½d. | Oriental Telephone & Elec. Co., Ltd. | 1 | 1¼ — 1⅜ |
| 50,000 | 1 | 7½d. | Do. 6% Cum. Pref. .. .. | 1 | 1$\frac{3}{16}$ — 1$\frac{5}{16}$ |
| £100,000 | 100 | 4% | Pacific & European Tel. 4% Guar. Debs. Red... | 100 | 99 —102 |
| 11,839 | 8 | 4/- | Reuter's Telegram Co., Ltd. .. | 8 | 7¾— 8¼ |
| 58,000 | 5 | 3/- | United River Plate Telep. Co., Ltd. | 5 | 7 — 7½ |
| 40,000 | 5 | 2/6 | Do. 5% Cum. Pref. .. .. | 5 | 5 — 5¼ |
| £179,947 | Stk | 5% | Do. 5% Deb. Stock, Red. .. | 100 | 107—109 |
| 15,609 | 10 | 4/- | W. African Telegraph Co., Ltd. .. | 10 | 8 — 8½ |
| £30,008 | 2½ | — | West Coast of America, Ltd. .. | 2½ | $\frac{5}{16}$— $\frac{7}{16}$ |
| 150,000 | 100 | 4% | Do. 4% Deb. Guar. by West. Tel. | 100 | 100 — 102 |

## TELEGRAPHS AND TELEPHONES.—*Contd.*

| Present Amount Subscribed. | Shares. | Last Dividend. | Name | Paid up. | Closing Prices. |
|---|---|---|---|---|---|
| 88,321 | 10 | 6d. | W. India & Panama Teleg. Co., Ld., Or. | 10 | $\frac{11}{16}$— $\frac{13}{16}$ |
| 34,563 | 10 | 6/- | Do. 6% Cum. 1st. Pref. .. | 10 | 8¼— 8¾ |
| 4,669 | 10 | 6/- | Do. 6% Cum. 2nd Pref. .. | 10 | 8 — 8½ |
| £80,000 | 100 | 5% | Do. 5% Deb. .. .. .. | 100 | 103 —105 |
| 207,930 | 10 | 3/- | Western Telegraph Co., Ltd. .. | 10 | 13½— 14* |
| £75,000 | 100 | 5% | Do. 5% Debs., 2nd Series, 1906 | 100 | 101 —103 |
| 518,945 | Stk | 4% | Do. 4% Deb. Stock, Red. .. | 100 | 103 —105 |

## VI.—SHIPPING COMPANIES.

| Present Amount Subscribed. | Shares. | Last Dividend. | Name. | Paid up. | Closing Prices. |
|---|---|---|---|---|---|
| 32,500 | 10 | 5/6 | Anchor Line (Henderson Bros.), Ltd., 5½% Cum. Pref. | 10 | 8¾— 9¼ |
| £325,000 | Stk | 4½% | Do. 4½% Red. 1st Mort. Deb. Stk. | 100 | 100—102 |
| £672,900 | Stk | 4½% | British & African Stm. Nav. (1900) Ltd., 4½% 1st Mort. Deb. Stk., Red. | 100 | 97 — 99 |
| 40,000 | 10 | 5/6 | Bucknall Steamship Lines, Ltd., 5½% Cum. Pref. | 10 | 5¾— 6¼* |
| £600,000 | Stk | 4½% | Do. 4½% 1st Mort. Deb. Stk. | 100 | 81 — 84 |
| £750,000 | Stk | 4½% | Clan Line Steamers, Ltd., 4½% Deb. Stk. Red. .. | 100 | 100 —102 |
| 60,000 | 20 | 16/- | Cunard Steam Ship Co., Ltd., Nos. 1-60,000.. | 20 | 12 -- 13 |
| 40,000 | 20 | 8/- | Do. Nos. 60,001-100,000 | 10 | 5 — 5½ |
| £464,430 | Stk | 4½% | Elder Dempster Shipping, Ltd., 4½% 1st Mort. Deb. Stk. .. | 100 | 101 —103 |
| 1,200,000 | 1 | 6d. | Furness, Withy & Co., Ltd., Ord... | 1 | 1¼— 1⅜ |
| 25,328 | 7½ | 4/7 | Gen. Steam Navigation Co., Ld., Ord. | 7½ | 5 — 5½ |
| 36,758 | 8 | 4/9⅗ | Do. Non-Cum. 6% Pref. .. .. | 8 | 8 — 8½ |
| £150,000 | Stk | 4% | Do. 4% 1st Mort. Deb. Stk. Red. | 100 | 100—102 |
| 55,000 | 5 | 1/3 | Houlder Line, Ltd., Ord. .. .. | 5 | 2¼— 2¾ |
| 40,000 | 5 | 2/9 | Do. 5½% Cum. Pref. .. .. | 5 | 3 — 3½ |
| £200,000 | Stk | 4½% | Do. 4½% 1st Mt. Deb. Stk. Red. | 100 | 83 — 86 |
| 141,500 | 10 | 5/- | Leyland (Fredk.), & Co., (1900), Ltd., 5% Cum. Pref... | 10 | 5¼ 5¾ |
| £1,160,000 | Stk | 5 % | Peninsular and Oriental Steam Nav. Co., 5% Cum. Pref. .. | 100 | 132 —136 |
| £1,160,000 | Stk | 19% | Do. do. Deferred .. | 100 | 229 —232 |
| 15,000 | 100 | 30/- | Royal Mail Steam Packet Co. Ord.. | 60 | 25 — 26 |
| 39,075 | 5 | 2/6 | Shaw, Savill & Albion, Ltd., 5% Cum. "A" Pref.. | 5 | 4¾— 5¼ |
| 39,075 | 5 | 2/6 | Do. "B" Ord... .. .. | 5 | 4 — 4½ |
| 141,841 | 10 | 4/- | Union Castle Mail Steamship Co., Ltd., Ord.. | 10 | 8¼— 8¾ |
| 24,000 | 10 | 4/6 | Do. 4½% Cum. Pref... .. | 10 | 10¼— 10¾ |
| £1,008,894 | Stk | 4% | Do. 4% Debenture Stk., Red. | 100 | 100 —102 |

## VII.—MISCELLANEOUS COMPANIES.

| Present Amount Subscribed. | Shares. | Last Dividend. | Name. | Paid up. | Closing Prices. |
|---|---|---|---|---|---|
| 60,000 | 1 | 9⅗d. | Chadburn's (Ship) Tele. Ltd., Ord... | 1 | 1— 1⅛ |
| £750,000 | Stk | 9% | General Hydraulic Power Co., Ltd. | 100 | 130 —135 |
| 12,500 | 10 | 10/- | Oakey (John) and Sons, Ltd., Ord.. | 10 | 24 — 26 |
| 10,000 | 10 | 6/- | Do. do. 6% Cum. Pf. | 10 | 14 — 15 |
| 183,538 | 1 | 6·3d. | Power Gas Corp., Ltd., Ord., Nos. 66,463-250 .. .. .. | 15/- | $\frac{5}{16}$— $\frac{7}{16}$ |
| 66,462 | 1 | 8·4d. | Do. do. Nos. 1 66,462 | 1 | $\frac{9}{16}$— $\frac{11}{16}$ |
| 135,000 | 1 | 6d. | Waygood (R.) & Co., Ltd., Ord. .. | 1 | 1$\frac{1}{16}$— 1$\frac{3}{16}$ |
| 135,000 | 1 | 7½d. | Do. 6% Cum. Pref. ... | 1 | 1⅛— 1¼ |

## RAILWAY CARRIAGE & WAGON COMPANIES.

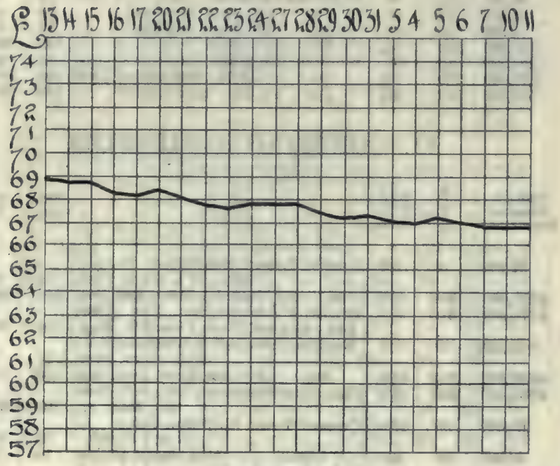
| Present Amount Subscribed, | Shares. | Last Dividend. | Name. | Paid up. | Closing Prices. |
|---|---|---|---|---|---|
| 10,000 | 10 | 7/6 | Birm. Railway-Car. & Wagon, L., 1-10,000 | 10 | 22½—23 |
| 8,739 | 10 | 3/- | Do. Second Issue 1-8,739.... | 4 | 8¾— 9 |
| 10,000 | 10 | 6/- | Do. Cum. Pref. 6% 1-10,000.. | 10 | 13 —13¼ |
| 30,111 | 7 | 7/- | Gloucester Rail.-Car & Wagon, Ld., A, 1-29,861 & 49,751-50,000 | 7 | 9 — 9½ |
| 44,889 | 7 | 3/6 | Do. B, 29,862-49,750, 50,001-75,000 | 7 | 3⅞— 4⅛ |
| 14,567 | 10 | 1/8 | Lancashire Wagon, Ord. .. .. | 2 | 2$\frac{3}{16}$—2$\frac{5}{16}$ |
| 4,150 | 10 | 5% | Do. do. .. .. | 10 | 10½— 10¾ |
| 784,808 | 1 | 9d. | Metropolitan Amalgamated Rail.-Carriage & Wagon, Ld., 1-784,808 | 1 | 42/3—42/9 |
| 164,288 | 1 | 6d. | Do. Cum. A Pref. 5% 1-164,288 | 1 | 24/-—25/- |
| 235,000 | 1 | 7½d. | Do. Cum. B Pref. 6% 1-235,000 | 1 | 27/- — 28/- |
| 20,000 | 20 | 20/- | Midland Rail.-Car. & Wagon, Ld., 1-20,000 | 10 | 18¾—19¼ |

Stocks and Shares marked * are quoted ex-dividend.

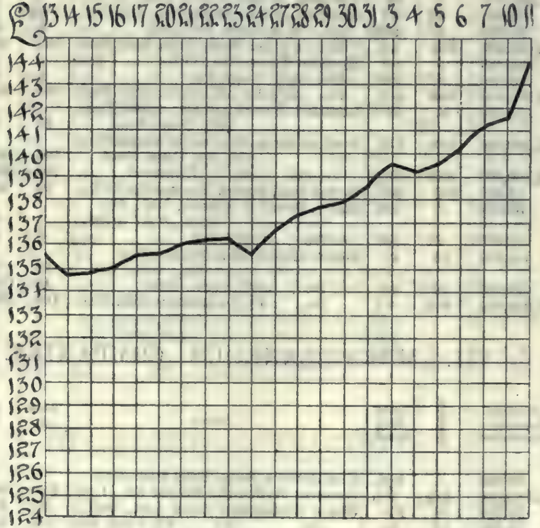
# THE HOME METAL MARKET.

SHOWING DAILY FLUCTUATIONS FROM MARCH 13TH TO APRIL 11TH, 1905.

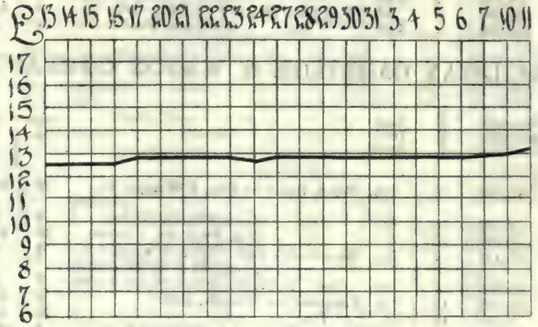
## COPPER.



## TIN.



## ENGLISH LEAD.



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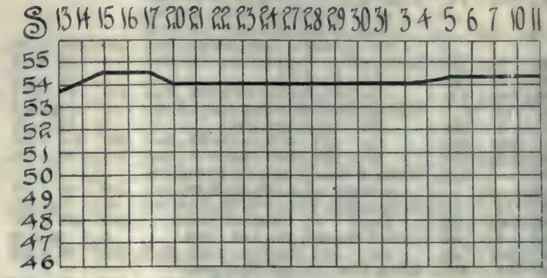

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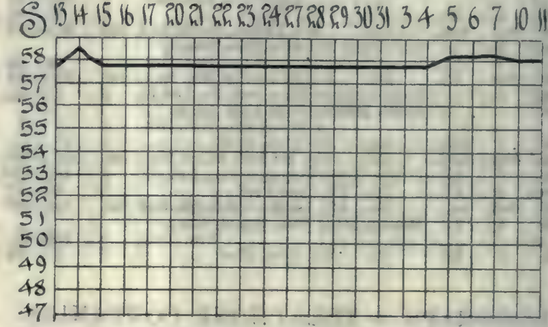

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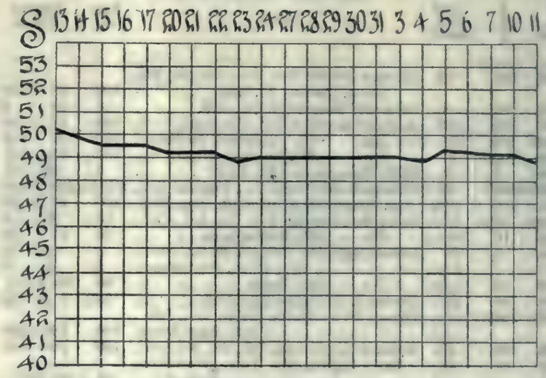
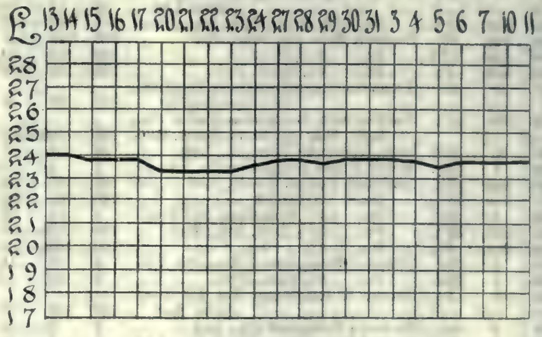


## SPELTER.



# PRICES CURRENT OF COAL, IRON, STEEL, AND OTHER METALS.

## MANUFACTURERS' AND MERCHANTS' QUOTATIONS.

## MARKET REPORT.

*Wednesday, April 12th,* 1905.

THE course of the Copper market has been somewhat disappointing, and prices are lower on balance, although the latest tendency shows a moderate amount of activity with some recovery in quotations. As is pointed out by Messrs. Merton and Co.'s circular, the industrial activity in the United States continues to expand and is extending to all branches of the metal industry. The falling off in the supplies to Europe has had the effect of considerably depleting the stocks of copper at consuming centres, and it is to be noted that European manufacturers are quite alive to the position, and that contrary to their usual habit of withholding orders in dull markets, they have been making free purchases of refined copper for immediate delivery. The price closed to-night at £67 10s. 0d. cash and £68 three months.

Tin has followed the course we marked out for it, the market having gathered strength from day to day owing to the ease with which the small stocks now in existence can be controlled by the bull party. There has been a bear squeeze during the week, and as large deliveries have still to be covered in the market, it is likely that prices will be put to a still higher level. It is estimated that the United States during this and next month will have to call upon Europe for about 2,000 tons of tin, and as home manufacturers are not well covered, it would be easy to bring about a further rise in quotations. The price has risen for cash to £144 12s. 6d., three months being quoted at £136 5s.

The Lead market shows continued firmness on the large demand for Russian account, and the latest prices are soft foreign April, May, £12 16s. 3d.; English, £13 1s. 3d.

A fair amount of business has been transacted on the Pig Iron market, and the tone has been firm, notwithstanding the liquidation of a large bull account. The present position in America is not quite so strong, but the situation at home and on the Continent has improved, German advices in particular reporting a large trade. It is undeniable, too, that the outlook in the United States is extremely satisfactory, and it may be pointed out that the price of pig iron is rapidly approaching the level which will bring about imports of British brands.

## IRON, STEEL, PIG-IRON, &c.

### SCOTLAND.

**Messrs. David Colville and Sons, Ltd., Dalzell Steel and Iron Works, Motherwell, N.B.,** quote as follows. Prices delivered in Glasgow or equal:—

**Steel:**

| | | £ | s. | d. |
|---|---|---|---|---|
| DALZELL | Siemens' Steel Plates, Marine Boiler Quality | 6 | 15 | 0 |
| ♛♛ | ,, ,, ,, Land ,, ,, | 6 | 17 | 6 |
| STEEL | ,, Steel Bars, Boiler Quality | 6 | 17 | 6 |
| DALZELL | Siemens' Steel Plates, Ship Quality Plates | 5 | 17 | 6 |
| ♛ | ,, ,, Bars ,, ,, | 6 | 7 | 6 |
| STEEL | ,, ,, Angles | 5 | 7 | 6 |

**Manufactured Iron:**

| | £ | s. | d. |
|---|---|---|---|
| **Bars**—Dalzell | 6 | 2 | 6 |
| ,, Best | 6 | 12 | 6 |
| ,, ,, Horseshoe | 6 | 12 | 6 |
| ,, Angle | 6 | 2 | 6 |
| ,, Best Angle | 6 | 12 | 6 |
| ,, Best Best | 7 | 2 | 6 |
| ,, Extra Best | 7 | 12 | 6 |

Usual terms and extras. Special rates for delivery in England and export. The above prices subject to alteration without notice.

**The Glasgow Iron and Steel Co., Ltd., Wishaw,** quote as under (prices are delivered Glasgow or equal):—

| | £ | s. | d. | |
|---|---|---|---|---|
| Steel Angles (Glasgow ♔ Steel) | 5 | 7 | 6 | per ton. |
| Steel Ship Plates (Glasgow ♔ Steel) | 5 | 17 | 6 | ,, |
| Steel Bars, Ship Quality (Glasgow ♔ Steel) | 6 | 7 | 6 | ,, |
| Steel Bars, Boiler Quality (Glasgow ♛ ♛ Steel) | 6 | 17 | 6 | ,, |
| Steel Land Boiler Plates (Glasgow ♛ ♛ Steel) | 6 | 7 | 6 | ,, |
| Steel Marine Boiler Plates (Glasgow ♛ ♛ Steel) | 6 | 7 | 6 | ,, |

Less 5 per cent. discount. Extras as per standard list.

Special prices for delivery in England and for export. The above prices subject to alteration without notice.

**John Spencer (Coatbridge), Ltd., Phœnix Ironworks, Coatbridge, N.B.,** quote:—

| | £ | s. | d. |
|---|---|---|---|
| **Bars**—Phœnix | 6 | 5 | 0 |
| ,, Best | 6 | 15 | 0 |
| ,, Best Best | 7 | 5 | 0 |
| ,, Extra Best | 7 | 15 | 0 |
| ,, Best Horse Shoe | 6 | 15 | 0 |
| ,, Extra B.H.S. | 7 | 15 | 0 |
| ,, Extra Best Cable | 8 | 5 | 0 |
| ,, Rivet | 6 | 5 | 0 |
| ,, Best Scrap Rivet | 7 | 5 | 0 |

| | £ | s. | d. |
|---|---|---|---|
| **Angles**—Phœnix | 6 | 5 | 0 |
| ,, Best | 6 | 15 | 0 |
| ,, Extra Best | 7 | 5 | 0 |
| **Gas Tube Hoops**—Phœnix Best | 6 | 15 | 0 |
| **Plates**—Phœnix | | — | |
| ,, Best Boiler | 7 | 10 | 0 |
| ,, Best Best Boiler | 8 | 0 | 0 |
| ,, Extra Best Boiler | 9 | 0 | 0 |
| **Boiler Tube Strips**—Phœnix Best Best | 8 | 0 | 0 |

All per ton, delivered f.a.s., Glasgow, Greenock, Grangemouth, Granton, Leith, or Ardrossan, 5 per cent. discount cash monthly.

**Messrs. R. Feldtmann and Co., of Glasgow,** quote Commission extra).

| **Pig Iron:** | No. 1. £ | s. | d. | No. 3. £ | s. | d. |
|---|---|---|---|---|---|---|
| Coltness, f.a.s. Glasgow | 3 | 4 | 6 | 2 | 14 | 0 |
| Gartsherrie ,, | 2 | 19 | 0 | 2 | 14 | 0 |
| Summerlee ,, | 2 | 19 | 0 | 2 | 14 | 0 |
| Carnbroe ,, | 2 | 16 | 6 | 2 | 12 | 6 |
| Langloan ,, | 3 | 4 | 0 | 2 | 15 | 0 |
| Calder ,, | 2 | 19 | 0 | | — | |
| Clyde ,, | 2 | 18 | 6 | 2 | 13 | 6 |
| Glengarnock, f.o.b. Ardrossan | 2 | 18 | 0 | 2 | 12 | 6 |
| Eglinton ,, ,, | 2 | 14 | 6 | 2 | 12 | 6 |
| Dalmellington, ,, Ayr | 2 | 14 | 6 | 2 | 12 | 6 |
| Shotts ,, Leith | 2 | 19 | 0 | 2 | 14 | 6 |

## NORTH OF ENGLAND.

**Messrs. W. Whitwell and Co., Ltd., Thornaby Ironworks, Stockton,** quote as follows, **at works:—**

| | £ | s. | d. |
|---|---|---|---|
| W.W. ♛ Bars | 6 | 12 | 6 |
| W.W. Best Bars | 7 | 2 | 6 |
| W.W. Best Best | 7 | 12 | 6 |
| W.W. Best Best Best | 8 | 2 | 6 |
| W.W. Best Shoe | 7 | 2 | 6 |
| Thornaby ♛ | 8 | 2 | 6 |
| Thornaby Best | 8 | 12 | 6 |
| Thornaby Best Best | 9 | 12 | 6 |
| Whitwell Special Admiralty Cable | 10 | 5 | 0 |
| Special Chain Iron | 9 | 15 | 0 |
| Tube and Nail Strips | 6 | 15 | 0 |
| W.W. ♛ Angle Iron | 6 | 15 | 0 |
| W.W. Best Angle Iron | 7 | 5 | 0 |
| Tee Iron, to 8-inches United | 7 | 12 | 6 |

Terms, Cash, less 2½ per cent. discount on 10th of month following delivery.

## LANCASHIRE.

**The Pearson and Knowles Coal and Iron Company, Ltd. Dallam and Bewsey Forges, Warrington,** quote :—

| | | Iron. £ | s | d. | Steel. £ | s. | d. |
|---|---|---|---|---|---|---|---|
| ♛ (BNF) | Bars | 6 | 10 | 0 | 6 | 15 | 0 |
| | Angles | 7 | 0 | 0 | 7 | 5 | 0 |
| | Tees | 7 | 10 | 0 | 7 | 15 | 0 |
| ♛ W.I.W | Hoops | 7 | 0 | 0 | 7 | 10 | 0 |
| | Sheets | 7 | 10 | 0 | 8 | 0 | 0 |

Ordinary Sizes, F.A.S. Liverpool in 10-ton Lots.
Extras for Sizes and Cutting as per List.

## WORCESTERSHIRE.

**Baldwins Ltd. (with which is amalgamated Knight and Crowther, Ltd.), Wilden Works, near Stourport,** quote :—

| **Black Sheets:** | Singles 20 G 96in. by 36in. per ton. £ | s. | d. | Doubles 21 G to 24 G 96in. by 36in. per ton. £ | s. | d. |
|---|---|---|---|---|---|---|
| "Vale" | 10 | 0 | 0 | 10 | 10 | 0 |
| "Shield" | 10 | 10 | 0 | 11 | 10 | 0 |
| "Severn" | 11 | 10 | 0 | 12 | 10 | 0 |
| "Baldwin Wilden B." | 12 | 10 | 0 | 13 | 10 | 0 |
| Charcoal | 16 | 10 | 0 | 17 | 10 | 0 |
| Best Charcoal | 18 | 10 | 0 | 19 | 10 | 0 |

Pickled, cold-rolled and close annealed sheets specially quoted for.

Extra widths, Singles to 66in., Doubles to 56in., Lattens to 46in. Extra lengths, Singles to 168in., Doubles to 132in., Lattens to 108in.

| **Patent Coated Sheets:** | £ | s. | d. | £ | s. | d. |
|---|---|---|---|---|---|---|
| No. 3 Lead | 13 | 10 | 0 | 14 | 10 | 0 |
| S.V. Lead | 15 | 0 | 0 | 16 | 0 | 0 |
| No. 3 Terne | 15 | 0 | 0 | 16 | 0 | 0 |
| S.V. Terne | 16 | 10 | 0 | 17 | 10 | 0 |

| **Tinned Sheets:** | Singles 20 G to 108 by 36in. per ton. £ | s. | d. | Doubles 21 to 24 G to 96 by 36in. per ton. £ | s. | d. |
|---|---|---|---|---|---|---|
| Best Coke (Finish) | 28 | 0 | 0 | 29 | 10 | 0 |
| ,, Charcoal (Finish) | 30 | 0 | 0 | 31 | 10 | 0 |
| Extra ,, ,, | 32 | 0 | 0 | 33 | 10 | 0 |

Cotton Can Tin Sheets to 39in. by 36in. specially quoted for.

Tin Plates, "Cookley, K" Best Charcoal, £1 7s. 0d. per box.

Extreme sizes in Tin and Patent Coated specially quoted for.

Lattens up to 36 wide by 27 W.G. £1 10s. 0d. per ton extra throughout for all brands.

At works less 2½% for cash monthly, 10th nst.

| **Galvanized Corrugated Sheets:** | £ | s. | d. | |
|---|---|---|---|---|
| "Phœnix" Brand, 24 G., f.o.b. London, in Bundles | 11 | 12 | 6 | per ton. |
| "Blackwall" Brand, 26 G., in felt-lined cases for Australia, f.o.b. London | 14 | 5 | 0 | ,, |

| **Galvanized Working Up-Sheets:** | £ | s. | d. | |
|---|---|---|---|---|
| 24 G., f.o.b. London, in Bundles | 13 | 12 | 6 | per ton. |

## STAFFORDSHIRE.

**Shelton Iron, Steel, and Coal Co., Ltd., Stoke-on-Trent, North Staffordshire, and 122, Cannon Street, London,** quote :—

| | £ | s. | d. | |
|---|---|---|---|---|
| Crown Bars | 6 | 10 | 0 | per ton. |
| Best Bars (1 to 6in. wide, above ¼ in. thick, ½ in. to 4 rounds and squares) | 7 | 0 | 0 | ,, |
| Angles | 6 | 15 | 0 | ,, |
| ,, Best | 7 | 5 | 0 | ,, |
| T's | 7 | 0 | 0 | ,, |
| ,, Best | 7 | 10 | 0 | ,, |
| Best Shoe Iron | 8 | 0 | 0 | ,, |
| ,, Rivet Iron | 8 | 0 | 0 | ,, |
| ,, Best Rivet (Special) | 9 | 5 | 0 | ,, |
| ,, Cable | 9 | 5 | 0 | ,, |
| ,, Screwing | 8 | 5 | 0 | ,, |

| | £ | s. | d. | |
|---|---|---|---|---|
| Best Turning | 8 | 0 | 0 | per ton. |
| ,, Plating | 8 | 5 | 0 | ,, |
| Best Best | 9 | 5 | 0 | ,, |
| Treble Best | 10 | 5 | 0 | ,, |
| Plates | 7 | 10 | 0 | ,, |
| Best Plates | 8 | 0 | 0 | ,, |
| ,, Boiler Plates | 8 | 10 | 0 | ,, |
| ,, Best Boiler Plates | 9 | 10 | 0 | ,, |
| Treble Best Boiler Plates | 12 | 0 | 0 | ,, |

Delivery f.o.b. Liverpool, Birkenhead or Manchester.

## WALES.

**Cordes (Dos Works), Ltd., of Newport, Mon.,** quote "Star" brand patent wrought nails, steel nails, &c.

### Discounts—

45 per cent. off 1-inch to 3-inch strong rose and all fine rose and 6dy. and 8dy. pound.

40 per cent. off 3½ inch to 7-inch strong rose and 10dy. and 20dy. pound.

40 per cent. off all sharp-pointed nails.

Delivered in lots of 4 cwt. and upwards. Extra 2½ per cent. discount off the gross on two tons and upwards.

Steel rose, flat points, 5-inch to 7-inch basis:—

2 tons 9/6 per cwt.
4 cwt. lots and upwards 9/9 per cwt. } d/d any Railway Station.

Steel cut nails, 3-inch basis—

2 tons 8/3 per cwt.
4 cwt. lots 8/6 per cwt. } d/d any Railway Station.

Slit rods (iron) £7 10s. per ton, at works for 2-ton lots.

**Messrs. Richard Thomas and Co., Ltd., of 33 and 35, Eastcheap, E. C. — Works: South Wales, Burry, Lydney, Lydbrook, and Cwmbwrla,** quote:—

| **Coke Tin-plates.** | Per Box. f.o.b. Wales. £ | s. | d. |
|---|---|---|---|
| C 18¾ by 14 124s. 110 lb. "BV" | 0 | 12 | 0 |
| C 20 by 10 225s. 155 ,, "Jumbo" | 0 | 17 | 0 |
| C 20 by 14 112s. 108 ,, "Lydbrook" | 0 | 11 | 9 |
| C 28 by 20 112s. 216 ,, "Lydbrook" | 1 | 3 | 9 |
| **Charcoal Tinplates:** | | | |
| C 20 by 14 112s. 108 lb. "Allaway" | 0 | 12 | 6 |

## BELGIUM.

**C. L. Faulkner, Suffolk House, Laurence Pountney Hill, London, E.C.,** quotes:—

Prices quoted are in £ stg. and per ton of 1,015 kos. (2,240 lb.) delivered free on board ANTWERP for approved quantities.

| | £ | s. | d | |
|---|---|---|---|---|
| **Steel:** | | | | |
| Blooms | at 3 | 14 | 0 | per ton. |
| Billets | at 3 | 16 | 0 | ,, |
| Sheet Bars | at 3 | 18 | 0 | ,, |
| **Finished Steel:** | | | | |
| Bars | at 5 | 1 | 0 | per ton. |
| Angles | at 5 | 2 | 0 | ,, |
| Tees | at 5 | 5 | 0 | ,, |
| Joists | at 4 | 10 | 0 | ,, |
| Fencing Standards | at 5 | 2 | 0 | ,, |
| Shoeing Bars | at 5 | 4 | 0 | ,, |
| Tyre Bars | at 5 | 4 | 0 | ,, |
| Half-Round Bars | at 5 | 5 | 0 | ,, |
| Heavy Rails | at 4 | 15 | 0 | ,, |
| Light Rails | at 4 | 17 | 6 | ,, |

**Structural Steelwork:**

Prices on application.

# METALS.

**Messrs. French and Smith, 147, Leadenhall Street, and 11, Oldhall Street, Liverpool,** quote:—

## TIN.

| **Tin:** | £ | s. | d. | | £ | s. | d. | |
|---|---|---|---|---|---|---|---|---|
| English Ingots, f.o.b. Dis. 1¼% & 1% | 140 | 0 | 0 | to | 143 | 0 | 0 | per ton. |
| English Bars, f.o.b. Dis. 1¼% & 1% | 141 | 0 | 0 | to | 144 | 0 | 0 | ,, |
| Straits G.M.B., cash Warehouse, Net | 143 | 5 | 0 | to | 143 | 10 | 0 | ,, |
| Straits G.M.B., 3 months, Warehouse, Net | 135 | 15 | 0 | to | 136 | 0 | 0 | ,, |
| Australian, Mt. Bischoff, Warehouse, Net | 143 | 5 | 0 | to | 143 | 10 | 0 | ,, |

## COPPER.

| **Copper:** | £ | s. | d. | | £ | s. | d. | |
|---|---|---|---|---|---|---|---|---|
| Standard G.M.B., cash Warehouse, Net | 67 | 10 | 0 | to | 67 | 11 | 3 | per ton. |
| Standard G.M.B., 3 months, Warehouse, Net | 67 | 17 | 6 | to | 68 | 0 | 0 | ,, |
| English, Tough, Cake & Ingot, Warehouses, Net | 70 | 5 | 0 | to | 70 | 15 | 0 | ,, |
| English, Best Select, Warehouse Net | 71 | 10 | 0 | to | 72 | 0 | 0 | ,, |
| English, Sheets and Sheathing, f.o.b., Dis. 2½% | 81 | 0 | 0 | to | 82 | 0 | 0 | ,, |
| English, Sheets for India, f.o.b., Dis. 2½% | 76 | 0 | 0 | to | 76 | 10 | 0 | ,, |
| Electro, Warehouse, Net | 70 | 15 | 0 | to | 71 | 0 | 0 | ,, |
| Ore, ex. ship | 0 | 12 | 1½ | to | 0 | 13 | 1½ | per unit. |
| Regulus, Matte and Precipitate, ex ship, | 0 | 13 | 4½ | to | 0 | 13 | 10½ | ,, |

## YELLOW METAL.

| **Yellow Metal:** | £ | s. | d. | |
|---|---|---|---|---|
| Sheets, 4 by 4 feet for India f.o.b. Dis. 2½% | 0 | 0 | 6¾ | per lb. |
| Sheathing ,, ,, | 0 | 0 | 6⅝ | ,, |

## SPELTER.

| | £ | s. | d. | | £ | s. | d. | |
|---|---|---|---|---|---|---|---|---|
| **Silesian** outports, Net | 23 | 10 | 0 | to | 23 | 12 | 6 | per ton. |
| **Blende** of 50 % Net | 6 | 9 | 6 | to | 6 | 12 | 6 | ,, |
| **Calamine**, Net | 6 | 12 | 0 | to | 6 | 14 | 0 | ,, |

## LEAD.

| | £ | s. | d. | | £ | s. | d. | |
|---|---|---|---|---|---|---|---|---|
| **English Pig**, Warehouse, Dis. 2½% | 13 | 0 | 0 | to | 13 | 2 | 6 | per ton. |
| **Spanish**, ex ship, Dis. 2½% | 12 | 16 | 3 | to | 12 | 17 | 6 | ,, |
| **Lead Ore** of 70 %, Net | 6 | 9 | 0 | | | — | | ,, |

## ANTIMONY.

| | £ | s. | d. | | £ | s. | d. | |
|---|---|---|---|---|---|---|---|---|
| **Star Regulus**, f.o.b., Dis. 2½ % | 35 | 0 | 0 | to | 36 | 0 | 0 | per ton. |
| **Ore**, 50 %, ex ship, Dis. 2½% | 7 | 10 | 0 | to | 8 | 10 | 0 | ,, |
| **Crude**, ex ship, Dis. 2½ % | 14 | 0 | 0 | to | 16 | 0 | 0 | ,, |

## QUICKSILVER.

| | £ | s. | d. | |
|---|---|---|---|---|
| **Spanish**, 75 lb., Warehouse, Net | 7 | 12 | 6 | per flask |
| **Italian** ,, ,, ,, | 7 | 11 | 6 | ,, |

# COAL.

## LEICESTERSHIRE.

**The Nailstone Colliery Company, Leicester,** quote. Price per Ton at Pit of 20 Cwt., with ½ Cwt. per Ton for wastage —

| **Upper Main Seam.** | s. | d. |
|---|---|---|
| Main Coal | 7 | 0 |
| Best Hard Steam (hand picked, as used by the Railway Companies) | 5 | 6 |
| Best Hard Steam Cobbles (made through 6 in. mesh, free from slack) | 5 | 6 |
| Fine Slack | 0 | 6 |

Terms, net cash on 10th of month following delivery.

## DERBYSHIRE.

**The Manners Colliery Co., Ltd., of Ilkeston** quote as follows, per ton at pit:

| **Kilburn Coal:** | s. | d. |
|---|---|---|
| Best London Brights | 9 | 9 |
| Large Nuts (1½ to 3¼) | 9 | 6 |
| Small Nuts (¾ to 1½) | 6 | 0 |
| Rough Brights | 6 | 0 |
| Peas (⅜ to ¾) | 5 | 0 |
| Slack | 3 | 6 |
| Smudge | 2 | 0 |

| **Low Main (or Tupton) Coal:** | | |
|---|---|---|
| Low Main Brights | 7 | 6 |
| ,, ,, Nuts | 7 | 3 |
| Hards (Good Steam Coal) | 8 | 0 |
| Bakers' Nuts (1" to 2") | 6 | 6 |
| Slack | 3 | 6 |

**The Clay Cross Company's Collieries, Clay Cross, near Chesterfield,** quote:—

| | per ton at pit. s. | d. |
|---|---|---|
| Best Main Coal | 10 | 6 |
| Best Silkstone | 10 | 0 |
| Best House Coal | 8 | 6 |
| Best House Nuts | 8 | 0 |
| Treble Screened Cobbles | 7 | 9 |
| Best Cobbles | 7 | 3 |

## NOTTINGHAMSHIRE.

**The Digby Colliery Co., Ltd., near Nottingham,** quote per ton at pit:—

### Digby Coal:

| Steam. | s. | d. |
|---|---|---|
| Best Hand Picked Hard | 8 | 6 |
| Steam Hard | 7 | 3 |
| Hard Nuts | 6 | 6 |

### Gedling Colliery.

| High Hazel. | | |
|---|---|---|
| London Brights, 4 to 8 in. cube | 10 | 6 |
| Large Nuts, 2 to 4 in. cube | 8 | 6 |
| Small Nuts, 1 to 2 in. cube | 6 | 0 |
| Pea Nuts, ⅜ to 1 in. cube | 5 | 0 |

| Steam.—Top Hard. | | |
|---|---|---|
| Best Hard | 8 | 6 |
| Hard Steam | 7 | 6 |
| Cobbles | 6 | 6 |

# CHEMICALS.

**Messrs. S. W. Royse and Co., Albert Square, Manchester,** quote:

| | £ | s. | d. | |
|---|---|---|---|---|
| **Acids:** Oxalic | 0 | 0 | 2½ | per lb |
| Picric, Crystals | 0 | 0 | 11 | ,, |
| Tartaric at Manchester | 0 | 0 | 10⅞ | ,, |

| | £ | s. | d. | |
|---|---|---|---|---|
| **Acetate of Lime:** Brown at Manchester net | 9 | 10 | 0 | per ton. |
| Grey ,, | 11 | 15 | 0 | ,, |
| **Alumina:** Alum, Lump, loose | 5 | 5 | 0 | ,, |
| ,, ,, in casks | 5 | 7 | 6 | ,, |
| ,, Ground, in bags | 5 | 15 | 0 | ,, |
| Sulphate of Alumina, 14% | 4 | 10 | 0 | ,, |
| **Ammonia:** Carbonate | 0 | 0 | 3⅝ | per lb. |
| Muriate Grey f.o.b. Liverpool | 23 | 15 | 0 | per ton. |
| Sal-ammoniac, Lump, 1sts, del$^{d.}$ U.K. | 42 | 0 | 0 | ,, |
| ,, ,, 2nds, ,, | 40 | 0 | 0 | ,, |
| Sulphate f.o.b. Liverpool | 12 | 12 | 6 | ,, |
| **Arsenic:** Best White Powdered net | 12 | 5 | 0 | ,, |
| **Bleaching Powder,** 35% ,, | 4 | 10 | 0 | ,, |
| **Borax:** British Refined Crystal ,, | 12 | 0 | 0 | ,, |

| **Coal Tar Products:** | | | | |
|---|---|---|---|---|
| Benzole, 50/90 % ,, | 0 | 0 | 6 | per gal. |
| ,, 90% ,, | 0 | 0 | 7 | ,, |
| Carbolic Acid Crystals, 34/35° C. ,, | 0 | 0 | 6 | per lb. |
| ,, ,, ,, 39/40° C. ,, | 0 | 0 | 6¼ | ,, |
| ,, ,, Liquid, 97/99 % ,, | 0 | 0 | 9 | per gal. |
| ,, ,, Crude, 62½% at 60° F. f.o.b. ,, | 0 | 1 | 9 | ,, |
| Creosote, ordinary good liquid ,, | 0 | 0 | 1$\frac{7}{16}$ | ,, |
| Naphtha, Crude, 20 % at 120° C. ,, | 0 | 0 | 3 | ,, |
| ,, Solvent, 90% at 160° C. f.o.b ,, | 0 | 0 | 8 | ,, |
| ,, ,, 95 % at 160° C. ,, ,, | 0 | 0 | 9 | ,, |
| ,, ,, 90 % at 190° C. ,, ,, | 0 | 0 | 10 | ,, |
| ,, Rectified, flash point over 73° F. f.o.b. ,, | 0 | 0 | 11 | ,, |
| ,, Rectified, flash point over 100° F. f.o.b. ,, | | 1 | 0 | ,, |
| Naphthalene, all qualities. | | | | |
| Pitch f.a.s. Manchester. ,, | 1 | 9 | 0 | per ton. |
| **Copperas:** Green, in bulk ,, | 0 | 12 | 6 | ,, |
| ,, barrels f.o.b. L'pool ,, | 1 | 19 | 0 | ,, |
| Cake ,, | 1 | 2 | 6 | ,, |
| **Copper:** Sulphate | 21 | 12 | 6 | ,, |
| **Cyanides:** 98% minimum f.o.b. net | 0 | 0 | 7½ | per lb. |
| **Lead:** Acetate (Sugar) White, English | 27 | 10 | 0 | per ton. |
| ,, ,, ,, Foreign c.i.f. U.K | 23 | 5 | 0 | ,, |
| ,, ,, Grey | 21 | 15 | 0 | ,, |
| ,, ,, Brown at Manchester | 16 | 15 | 0 | ,, |
| Nitrate | 24 | 0 | 0 | ,, |
| Litharge, Flake | 15 | 10 | 0 | ,, |
| ,, Powder | 16 | 0 | 0 | ,, |
| Red Lead, Genuine, c.i.f. London less 5% | 15 | 10 | 0 | ,, |
| White ,, ,, Dry ,, ,, ,, | 16 | 15 | 0 | ,, |
| **Naphtha (Wood):** Miscible, 60 o.p. | 0 | 2 | 10 | per gal. |
| Solvent | 0 | 2 | 7 | ,, |
| **Potash:** Bichromate... delivered England | 0 | 0 | 3 | per lb. |
| Carbonate, 90/92 % ... c.i.f Hull | 18 | 10 | 0 | per ton. |
| Caustic, 75/80 % ,, ,, | 20 | 15 | 0 | ,, |
| Chlorate net | 0 | 0 | 3$\frac{1}{16}$ | per lb. |
| Montreal in Store, Liverpool | 35 | 0 | 0 | per ton. |
| Prussiate, Yellow net | 0 | 0 | 5 | per lb. |

| | | £ | s. | d. | |
|---|---|---|---|---|---|
| **Soda:** | Ash, Caustic, 48 %, Ordinary ... net | 5 | 5 | 0 | per ton. |
| | ,, ,, ,, Refined...... ,, | 6 | 5 | 0 | ,, |
| | ,, Carbonated, 48 %............ ,, | 5 | 10 | 0 | ,, |
| | ,, ,, 58 % (Ammonia Alkali) .................. ..net | 4 | 10 | 0 | ,, |
| | ,, Bleachers' Refined Caustic 50/52 % .................. net | 6 | 10 | 0 | ,, |
| | Caustic, White, 77 %.............. ,, | 10 | 10 | 0 | ,, |
| | ,, ,, 70 %.............. ,, | 9 | 12 | 6 | ,, |
| | ,, ,, 60 %.............. ,, | 8 | 12 | 6 | ,, |
| | ,, Cream, 60 %.............. ,, | 8 | 10 | 0 | ,, |
| | Crystals, in bags ........................ | 3 | 0 | 0 | ,, |
| | ,, barrels ........................ | 3 | 7 | 6 | ,, |
| | Acetate .................. c.i.f. Hull net | 16 | 15 | 0 | ,, |
| | Bicarbonate, in 1 cwt. kegs............ | 6 | 15 | 0 | ,, |
| | Bichromate......delivered England... | 0 | 0 | 2¼ | per lb. |
| | Chlorate ................................ net | 0 | 0 | 3$\frac{1}{16}$ | per lb. |
| | Nitrate...ex quay Liverpool, ... ,, | 11 | 5 | 0 | per ton. |
| | Phosphate ................................ | 9 | 5 | 0 | ,, |
| | Prussiate ................................net | 0 | 0 | 3⅝ | per lb. |
| | Silicate, Solution, 140° Tw. ......... | 4 | 10 | 0 | per ton. |
| | Sulphate (Glauber Salts)............... | 1 | 12 | 6 | ,, |
| | ,, (Saltcake, 95%)............... | 1 | 15 | 0 | ,, |
| **Sulphur:** | Recovered ........................ | 4 | 15 | 0 | ,, |
| | Roll ................................ | 6 | 15 | 0 | ,, |
| | Flowers............................ | 7 | 10 | 0 | ,, |
| **Zinc:** | Sulphate ................................ | 6 | 15 | 0 | ,, |
| **Shellac:** | Standard TN orange spot ......... | 7 | 10 | 0 | per cwt. |

# MINERALS.

**Messrs. S. W. Royse and Co.,** quote:—

| | | £ | s. | d. | |
|---|---|---|---|---|---|
| **Barytes:** | Lump Carbonate, 90/92% ...... | 3 | 10 | 0 | per ton. |
| | Sulphate, No. 1, White............ | 2 | 15 | 0 | ,, |
| **China Clay:** | of various qualities for all purposes; prices from about 11/- to about 30/- per ton, f.o.b. Cornwall: stocks also kept at Runcorn and Preston. Quotations given carriage paid. | | | | |
| **Chrome Ore:** | Basis 50% c.i.f. British Ports......... ...... ..... | 3 | 7 | 6 | ,, |
| **Manganese:** | Lump c.i.f. Liverpool 10¼d. per metallic unit. | | | | |
| **Ochre:** | French JC ........ f.o.b. Rouen; net | 2 | 5 | 0 | per ton. |
| | ,, JF ................................ | 5 | 10 | 0 | ,, |
| **Talc:** | (French Chalk).........c.i.f. Liverpool | 3 | 10 | 0 | ,, |

**Messrs. Henry Bath and Son,** quote:—

| | £ | s. | d. | | £ | s. | d. | |
|---|---|---|---|---|---|---|---|---|
| **Copper,** Ores of, 10 to 25% | 0 | 12 | 1½ | to | 0 | 13 | 1½ | per unit. |
| Regulus, 45 to 55% ....... | 0 | 13 | 4½ | to | 0 | 13 | 10½ | ,, |
| Precipitate, 65 to 80% ... | 0 | 13 | 7½ | to | 0 | 14 | 1½ | ,, |
| **Tin Ores,** 70 %............... | 86 | 0 | 0 | to | 88 | 0 | 0 | per ton. |
| **Lead Ore,** 70%............... | | | | | 6 | 5 | 0 | ,, |
| **Blende,** 50% ............... | | | | | 6 | 9 | 6 | ,, |
| **Calamine**...................... | | | | | 6 | 12 | 0 | ,, |
| **Antimony Ore,** 50% ..... | 7 | 10 | 0 | to | 8 | 10 | 0 | ,, |

**Messrs. Barrington and Holt, Cartagena,** quote:—

**Iron Ore.**

| | | | s. | d. | |
|---|---|---|---|---|---|
| Ord. 50%, ... ........ | f.o.b. | Porman ............... | 6 | 5 | per ton. |
| Do. ................... | ,, | Cartagena ............ | 6 | 8 | ,, |
| Special low phos. | ,, | Porman ............... | 7 | 1 | ,, |
| Do. do. | ,, | Cartagena.............. | 7 | 4 | ,, |
| Extra quality do. | ,, | ,, ............ | 7 | 8 | ,, |
| Special Iron Ore | ,, | ,, ............ | 8 | 4 | ,, |
| Specular 58% do. | ,, | ,, ............ | 9 | 4 | ,, |

# TIMBER.

**Messrs. Alfred Dobell and Co., Liverpool,** quote:—

## COLONIAL WOODS.

**Timber.**

| | | £ | s. | d. | | £ | s. | d. |
|---|---|---|---|---|---|---|---|---|
| Quebec Square White Pine... | per cub. ft. | 0 | 1 | 9 | to | 0 | 3 | 3 |
| Quebec Waney Board Pine... | ,, | 0 | 2 | 8 | | 0 | 3 | 9 |
| St. John Pine, 18 in. average | ,, | 0 | 2 | 4 | | 0 | 3 | 3 |
| Lower Ports Pine............... | ,, | 0 | 1 | 3 | | 0 | 1 | 8 |
| Quebec Red Pine ............... | ,, | 0 | 1 | 6 | | 0 | 2 | 3 |
| Quebec Oak, 1st quality ...... | ,, | 0 | 2 | 9 | | 0 | 3 | 4 |
| Quebec Oak, 2nd quality ... | ,, | 0 | 1 | 6 | | 0 | 2 | 6 |
| Ash ........................ | ,, | 0 | 1 | 6 | | 0 | 2 | 3 |
| Elm .. ........................ | ,, | 0 | 3 | 3 | | 0 | 4 | 0 |
| Hickory ........................ | ,, | 0 | 2 | 0 | | 0 | 2 | 6 |
| Quebec Birch .................. | ,, | 0 | 1 | 6 | | 0 | 2 | 3 |
| St. John Birch ..... ............ | ,, | 0 | 1 | 6 | | 0 | 2 | 0 |
| Birch Planks..................... | ,, | 0 | 0 | 9 | | 0 | 0 | 11 |
| Spruce Spars .................. | ,, | 0 | 0 | 10 | | 0 | 1 | 0 |

**Deals.**

| | | £ | s. | d. | | £ | s. | d. |
|---|---|---|---|---|---|---|---|---|
| 1st quality Quebec Pine ...... | per std. | 22 | 10 | 0 | to | 32 | 10 | 0 |
| 2nd do. do. ...... | ,, | 17 | 0 | 0 | | 22 | 0 | 0 |
| 3rd do. do ...... | ,, | 11 | 10 | 0 | | 13 | 0 | 0 |
| St. John, N.B., etc., Spruce | ,, | 7 | 5 | 0 | | 7 | 15 | 0 |
| Nova Scotia Spruce.. .. ....... | ,, | 7 | 0 | 0 | | 7 | 10 | 0 |
| **Spruce Boards**................ | ,, | 5 | 15 | 0 | | 6 | 5 | 0 |

## UNITED STATES, etc., WOODS.

**Pitch Pine.**

| | | £ | s. | d. | | £ | s. | d. |
|---|---|---|---|---|---|---|---|---|
| Hewn ............................ | per cub. ft. | 0 | 1 | 4 | to | 0 | 1 | 8 |
| Sawn ..... ..... .................. | ,, | 0 | 1 | 0 | | 0 | 1 | 6 |
| Planks, Stowage .............. | ,, | 0 | 0 | 10 | | 0 | 1 | 0 |
| Boards, Prime .................. | per std. | 12 | 10 | 0 | | 16 | 0 | 0 |
| **Oak Timber** .................. | per cub. ft. | 0 | 1 | 6 | | 0 | 2 | 6 |
| **Oak Planks** .................. | ,, | 0 | 1 | 6 | | 0 | 2 | 1 |
| **East India Teak**............ | per load | 12 | 0 | 0 | | 16 | 0 | 0 |
| **Greenheart**..... ................ | ,, | 6 | 15 | 0 | | 7 | 10 | 0 |

## EUROPEAN WOODS.

**Timber.**

| | | £ | s. | d. | | £ | s. | d. |
|---|---|---|---|---|---|---|---|---|
| Riga Redwood .................. | per cub. ft. | 0 | 1 | 6 | to | 0 | 2 | 0 |
| Dantzic and Memel Fir, Crown ..................... | ,, | 0 | 2 | 1 | | 0 | 2 | 6 |
| Dantzic and Memel Fir, Middling .................... | ,, | 0 | 1 | 9 | | 0 | 1 | 11 |
| Stettin ........................... | ,, | 0 | 1 | 9 | | 0 | 1 | 11 |
| Swedish............................ | ,, | 0 | 1 | 0 | | 0 | 1 | 3 |
| Riga Whitewood ............... | ,, | 0 | 1 | 0 | | 0 | 1 | 3 |
| Norway Mining Timber ... .. | ,, | 0 | 0 | 9 | | 0 | 1 | 0 |
| Dantzic and Stettin, etc., Oak.. ........................... | ,, | 0 | 2 | 6 | | 0 | 3 | 0 |
| **Norway Spars**................ | ,, | 0 | 1 | 2 | | 0 | 1 | 9 |

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| Red Archangel and Onega, 3rd quality .................. | ,, | 10 | 10 | 0 | | 12 | 10 | 0 |
| St. Petersburg, 1st quality... | ,, | 16 | 0 | 0 | | 17 | 10 | 0 |
| Do. 2nd ,, ... | ,, | 14 | 0 | 0 | | 15 | 0 | 0 |
| Gefle ................................ | ,, | 11 | 10 | 0 | | 16 | 0 | 0 |
| Wyburg ........................... | ,, | 11 | 0 | 0 | | 12 | 10 | 0 |
| Uleaborg ........................ | ,, | 10 | 0 | 0 | | 12 | 10 | 0 |
| Gothenburg ...................... | ,, | 11 | 0 | 0 | | 16 | 0 | 0 |

# SELECTED PATENTS.

Compiled expressly for this journal by **Messrs. Page and Rowlingson, Engineering Patent Agents, 28, New Bridge Street, London, E.C.,** and at Manchester.

*Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton Buildings, Chancery Lane, W.C., at the uniform price of 8d.*

## NEW PATENTS APPLIED FOR.

When Patents have been communicated the names of the communicators are printed in *italics.*

### 1904.

**27050a. J. Hutchings, London.** March 28th, —Improvements in and relating to means and apparatus for generating motive power from the movements of tides, waves, or the like movements of water. (Date applied for, Dec. 12th, 1904.)

### 1905.

**6396. W. Rowbotham and I. M. C. J. de Havilland, Birmingham.** March 27th.—Improvements in and relating to turbines.

**6397. W. Rowbotham and I. M. C. J. de Havilland, Birmingham.** March 27th.—Improvements connected with the propulsion of ships and boats.

**6399. C. Reynolds, Wolverhampton.** March 27th.—Improvements in driving belts for use with grooved pulleys, more particularly belts for use with motor cycles and the like.

**6401. T. E. Mitton, Birmingham.** March 27th.—Improvements in lubricators or grease cups.

**6416. A. E. Woodland, Liverpool.** March 27th.—Improvements in grip tools, viz.: hand vices, pin vices, vices, pliers, gas tongs, blacksmiths' tongs, tap wrenches, stretchers, brace and lathe chucks.

**6418. A. B. Flobâck, Newcastle.** March 27th.—Improvements in instruments for water-gauging and sampling the oil in oil tanks of steamers and the like.

**6423. J. Bramwell, Manchester.** March 27th.—Improvements in the method of and means for recording the working of engine-room telegraphs and engines.

**6429. J. T. Dawes, Liverpool.**—March 27th. —Improvements in water-level indicators for steam generators or the like.

**6437. J. Fraser, Manchester.** March 27th. —Improvements in and relating to elastic fluid turbines.

**6441. R. Harding and G. Harding, Brixton.** March 27th.—Improved ball valve for filling and controlling the supply of water to enclosed hygienic cisterns, boilers, and the like.

**6445. C. J. Mayhew, Southsea.** March 27th. —Improvements in variable speed gearing.

**6450. H. Birkbeck, London.** March 27th. —Improvements in or relating to drilling and nailing machines. (*F. Wesel, U.S.A.*)

**6454. C. H. T. Alston, London.** March 27th. —An improved mechanical device for transmitting, retarding or accelerating, stopping, and reversing the he motion of shafts.

**6462. H. Phelan, London.** March 27th.—Improvements in wrenches. (Date applied for July 9th, 1904.)

**6465. The Firm Vereinigte Schmirgel- und Maschinenfabriken, Akt.-Ges., London.** March 27th.—Improved protective hood for grinding discs and for similar rotating objects and tools. (Date applied for, March 28th, 1904.)

**6466. W. S. Hyde, London.** March 27th.—Improvements in connection with steam-engine cylinders and slide valves.

**6472. G. Tua, London.** March 27th.—Waste-preventing tap.

**6475. E. Post, London.** March 27th—Improvements in cocks adapted to discharge a definite quantity of fluid. (Date applied for, March 28th, 1904.)

**6491. Sautter, Harlé and Cie, London.** March 27th.—The recovery of energy from hot liquids. (Date applied for, April 12th, 1904.)

**6493. J. Robert, London.** March 27th—Improvements in water-tube locomotive boilers.

**6513. H. C. Braun, London.** March 28th.— —Improvements in pipe shields and the like.

**6517. J. S. Lord, Manchester.** March 28th. —Improvements in rotary engines.

**6538. P. A. Vaile, London.** March 28th.—An improved propeller for boats.

**6551. W. H. Keys and G. H. Shakespeare, Birmingham.** March 28th.—Improvements in the manufacture of troughs and conduits for the distribution of electricity, water, steam, and the like.

**6582. B. B. Hill, London.** March 28th.—Improvements in fluid pressure engines.

**6590. F. L. Martineau, London.** March 28th. —Improvements in and relating to rotary pumps.

**6596. The Warwick Machinery Co., Ltd., London.** March 28th.—Improvements in elastic fluid turbines. (*General Electric Co., U.S.A.*)

**6598. The Warwick Machinery Co., Ltd., London.** March 28th.—Improvements in elastic fluid turbines. (*General Electric Co., U.S.A.*)

**6616. E. Morgan, Ystalyfera.** March 29th.—Improvements in and relating to combined spanners and pipe wrenches.

**6632.—J. Shanks, London.** March 29th.—Improvements in calorifiers or steam heaters.

**6635. W. G. Crosthwaite, Leeds.** March 29th.—Improvements in or relating to the furnaces of steam boilers, and the like.

**6648. J. J. Snow, London.** March 29th.—Improvements in pumps.

**6676. J. L. Didier, London.** March 29th.—Improvements in speed changing, or speed changing and reversing gear.

**6682. The Warwick Machinery Co., Ltd., London.** March 29th.—Improvements in and relating to elastic fluid turbines. (*General Electric Co., U.S.A.*)

**6683. O. Briede, London.** March 29th.—Improvements in or relating to the manufacture of screw-nuts, and the like. (Date applied for, April 27th, 1904.)

**6684. O. Briede, London.** March 29th.—Improvements in or relating to the manufacture of screw-nuts and the like. (Date applied for, June 8th, 1904.)

**6686. J. Saxton, London.** March 29th.—Improved chuck for the bits of coal or rock drills.

**6711. H. E. Moul, London.** March 30th.—Speed indicator.

**6714. E. MacKay, Glasgow.** March 30th.—Improvements in engine indicators.

**6725. L. Gallimore and S. Watson, Glasgow.** March 30th.—Improvements in or connected with means for preventing or consuming smoke in the furnaces of steam generators.

**6728. J. Shanks and A. Smith, London.** March 30th.—Improvements in combined cold and hot-water taps or valves.

**6756. A. Darch and T. Marriott, London.** March 30th.—Improvements relating to the manufacturing of artificial fuel.

## RECENT SPECIFICATIONS.

### PISTONS, AND PISTON VALVES, AND THEIR PACKINGS.

**T. Reading and A. J. Houghton, of Birkenhead.** Dec. 31st, 1904.—This invention has reference more particularly to pistons, and their packings, of fluid pressure engines, or of machines in which fluid is operated upon by a piston, but it is also applicable to piston valves; and it has for its chief object and effect to provide, in connection with such pistons or piston valves, improvements or an improved construction by which the packing can be removed as a whole from the piston body, and the cylinder in which it works, for repairs, readjustment of the rings vertically, or otherwise, or renewals; while at the same time, a further object is to enable the interior of the cylinder on both sides of the piston to be inspected by artificial light, without removing the piston. This is especially desirable and serviceable in connection with marine and other large engines. According to this invention the piston packing is carried in a carrier which extends or lies between the piston body periphery, and the interior of the cylinder, that is the space which lies between the piston body proper and the cylinder wall is filled with the carrier, which fits on and over the body periphery; and this carrier has an annular inwardly projecting flange at one part, which fits over the outer part of the piston, and is secured down on the same by suitable studs or bolts; whilst the opposite part of the carrier has an outwardly projecting annular flange, within which the packing ring or rings is disposed, and by which it is held at one side and in one direction, being held at the other side or direction by a junk ring or flange, held on the carrier ring, as in the case shown.

FIG.1

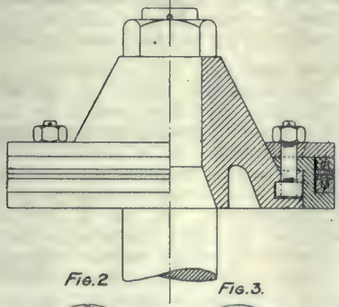

FIG.2

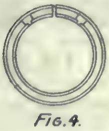

FIG.3

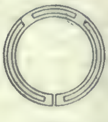

FIG.4.

FIG.5.

### AUTOMOBILE FIRE ENGINE.

**J. C. Merryweather, of Greenwich.** April 22nd, 1904.—The object of this invention is to construct an automobile vehicle carrying a pump to be driven by the same motor as that used for propelling the vehicle. One method of carrying out the invention is as follows: A four wheeled vehicle steered by the front wheels has fixed on to the front portion an explosion engine, using petrol or fuel of a like nature. The engine is connected to the driving wheels by means of a friction clutch, change speed gear of the sliding wheel type, differential gear and side chains. In the rear of the vehicle, and in a convenient position for obtaining access to it, a pump is arranged, preferably the type known as the "Hatfield" although not definitely confined to this type of pump. The pump is arranged so that the centre of the crankshaft lies in a parallel line with the crankshaft of the motor, and the shafts of the change speed gear, so that the pump may be driven at the same ratio of speed in relation to the motor, as that used for propelling the vehicle. One method employed for connecting the pump to the motor is to arrange a toothed wheel on the driven shaft of the change speed gear, engaging with a toothed wheel on a countershaft running parallel to the pump crankshaft by means of toothed wheels or other suitable gearing. The toothed wheel on the driven shaft of the change speed gear is arranged to slide out of gear by means of a suitably placed lever, so that the pump may be disconnected from the propelling gear when travelling. To disconnect the motor from the driving wheels, for the purpose of driving the pump, each half of the differential shaft carrying the toothed sprockets for driving the rear wheels of the vehicle is constructed in two pieces. The two pieces are joined by sliding sleeves operated by means of suitably placed levers.

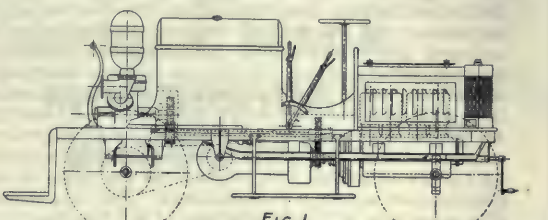

FIG 1

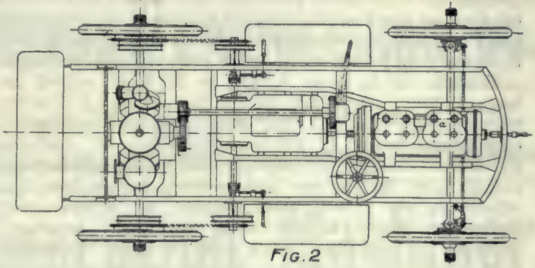

FIG.2

# NEW PUBLICATIONS.

### "APPLIED MECHANICS AND MECHANICAL ENGINEERING."

Specially arranged for the use of Engineers qualifying for the Institution of Civil Engineers, the diplomas and degrees of Technical Colleges and Universities, advanced science Certificates of British and Colonial Boards of Education, and Honours Certificates of the City and Guilds of London Institute, in Mechanical Engineering and Engineers generally. By Andrew Jamieson, M.Inst.C.E. Volume II. Fourth Edition, revised and enlarged, with numerous diagrams, special plates and examination questions. Charles Griffin and Co., Ltd. 12s. 6d.

Probably there is no writer more fully cognisant with the requirements of students of engineering, than Professor Andrew Jamieson, whose text-book on applied mechanics and mechanical engineering has again been enlarged and is now in its fourth edition. This work was specially designed for the use of those studying the second and third year's courses and it forms a continuation of the writer's elementary manual on the same topic. An essential feature of the book is the arrangement to enable teachers and students of engineering to ascertain by a study of the text, the worked-out examples of many questions set at recent examinations. The 1904 examination questions of the Institution of Civil Engineers, City and Guilds of London Institute, and Board of Education, on applied mechanics, strength and elasticity of materials, theory of structures and of machines as well as hydraulics have been included. The work of revision is particularly noticeable in lectures XXII. to XXXIII. which have been further elucidated by the inclusion of a number of fully worked-out and illustrated practical examples on centrifugal force, governors, balancing of machinery, dynamical loads on bearings, etc.; descriptions of and calculations for water and electric-driven centrifugal machines are given, accompanied by several special drawings, while in the four additional lectures on strength of materials, there will be found a number of figures relating to testing, testing machines, and stress-strain diagrams.

The following headings will serve to indicate the general scope of the work: velocity and acceleration; motion and energy; energy of rotation and centrifugal force; engine governors and other applications of centrifugal force; framed structures; roof frames; deficient frames; cranes; beams and girders; stress and strain, and bodies under tension; strength of shafts; strength of beams and girders; deflection of beams and girders; hydrostatics; hydraulic machines; hydro-kinetics; water wheels and turbines, and refrigerating machinery.

The book is admirably illustrated and lucidly written, and although planned for examination requirements, the author treats his subject in a manner that will not fail to render the work a valuable and informing volume even to those for whom it is not primarily intended.

## BOOKS RECEIVED.

"Work," an illustrated weekly journal of handicrafts. Vol. XXVIII. 1905. (Cassell and Co. 4s. 6d.) An extensive mine of information dealing in a popular style with matters of a technical interest.—"Electro Plating" with numerous engravings and diagrams. Edited by Paul N. Hasluck. (Cassell and Co. 1s. net.) An excellent little handbook containing a comprehensive digest of the information on this subject scattered over many volumes of the aforementioned journal.

# NEW CATALOGUES.

**The Napier Marine Motor** is the subject of an illustrated pamphlet issued by Messrs. S. F. Edge, Ltd., of 14, New Burlington Street, S.W. Amongst the illustrations are those of the "Napier Minor," a Napier 20 h.p. Marine Motor, and a 72-h.p. Napier Light Marine Motor.

**We have received** from the C. W. Hunt Co., pamphlet No. 051, devoted to the Hunt "Industrial" Railways, and pamphlet No. 052, an introduction to the general line of machinery manufactured by the firm. Also a useful metric conversion table already gummed for insertion in memorandum book.

**The Simplex Steel Conduit Company, Ltd.,** of London, Birmingham and Manchester, have just issued an embossed trade mark leaflet. This shows a few of their most used fittings and also gives a short classified list of Simplex Conduits and Accessories. Copies can be had on application to the general manager's office, 2, Westinghouse Buildings, Norfolk Street, Strand.

**The Mirrlees-Watson Company, Ltd.,** Glasgow. General Catalogue C 3 draws attention to the various types of condensing plant made by this firm. The conditions for which each of the three principal types—(1) Surface condensing, (2) Jet condensing (parallel flow type), and (3) Jet condensing (counter current type)—is most suitable, are briefly described, and the catalogue is freely illustrated.

**Gent and Co., Ltd.,** Faraday Works, Leicester, have published an illustrated catalogue of "Regent" Telephones, of British manufacture for office, warehouse and general purposes This type of telephone is made for three distinct purposes: (1) ordinary type for use in pairs; (2) intercommunication type, where any station can ring up or talk direct to any other station of the system; (3) central type, where a central having a switch, can ring up any sub-station, or any sub-station can ring up to central. In all three systems, a single or general battery serves all the telephones. These instruments are made in two patterns for fixing to wall, and also for table or desk use. They are being largely adopted in Government offices instead of the old-fashioned speaking tube.

**Arthur Cort and Co.,** 277, Camberwell New Road, S.E. The wholesale price list of insulating hard or flexible vulcanised fibre issued by this firm, has a quantity of concentrated information which should be useful for reference. It is pointed out that there is hardly any branch of engineering in which fibre cannot be employed with great advantage in the place of leather, india-rubber, etc. It is used, among other purposes, for electrical insulators, valves or washers for air circulating pumps, railway box washers for dust guards, oil box covers, etc., gibs for engine cross-heads, condenser ferrules for packing service condensers, journal bearings and bushings, thrust bearings and washers for lathes, drill presses and grinding mills of all kinds, rollers, etc., etc. The list gives tabulated details of the firm's balata, gutta percha and cotton beltings. These are described as waterproof and perfectly uniform all over, which makes them resistible and durable. They are used for electric lighting, grain, saw and paper mills, and dye, print and engineering works, etc. For cross-working and very hot rooms they are not advised, as extreme heat softens the balata, and thereby impairs the lasting of the belt. The joining is done in a similar way to leather with screws, clinches, laces, fasteners, etc. A 3-ply belt requires about ten inches to make it endless. The list also includes a section devoted to wholesale prices of gutta percha articles for mechanical and other purposes.

## PAGE'S WEEKLY Miscellaneous

# "IGRANIC"

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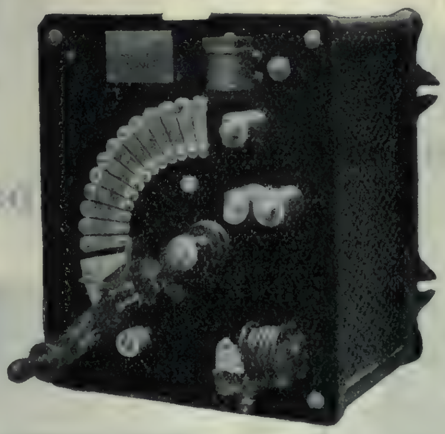

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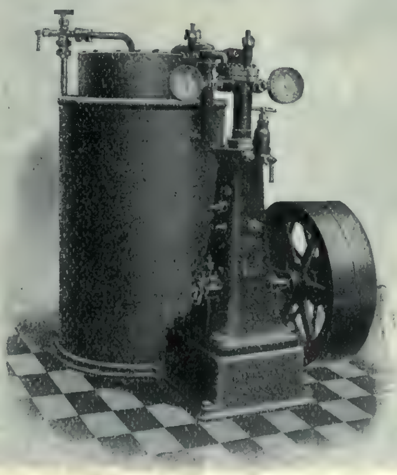

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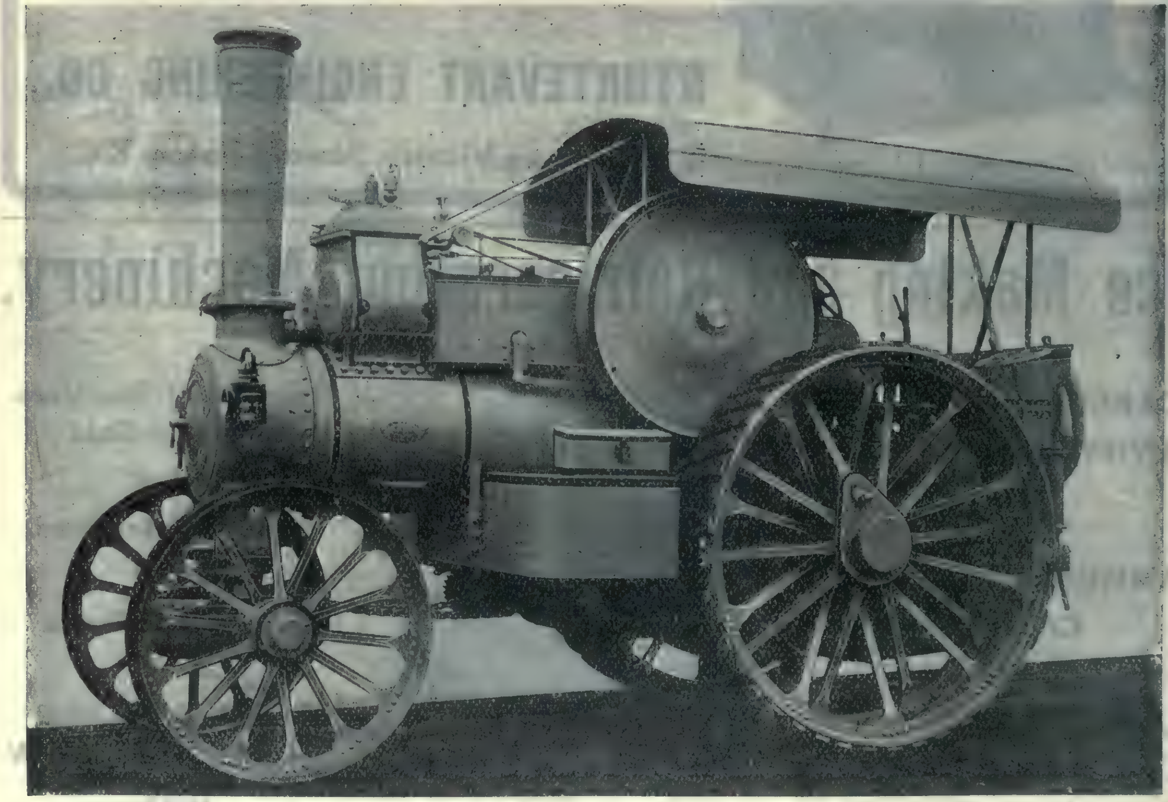

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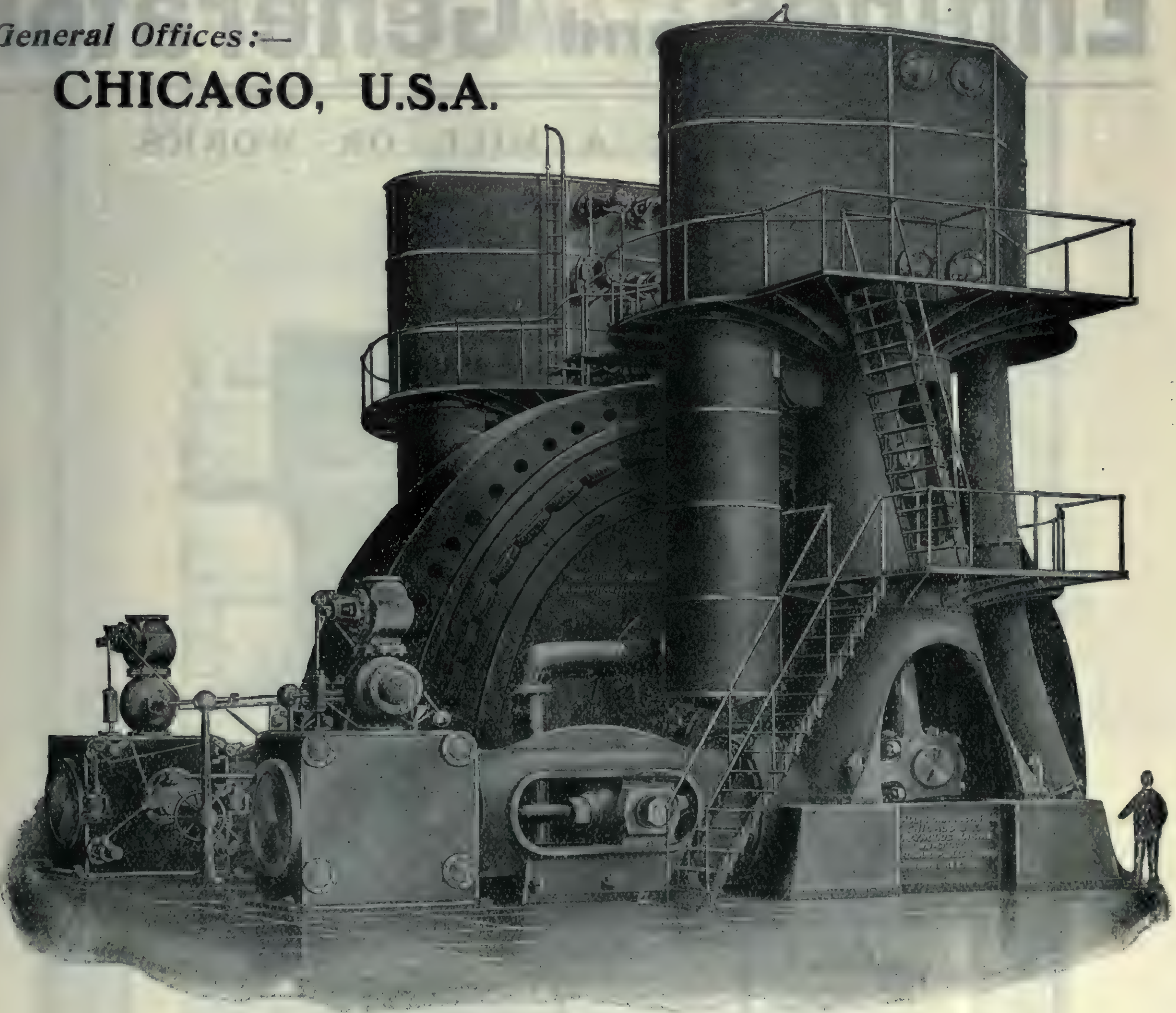

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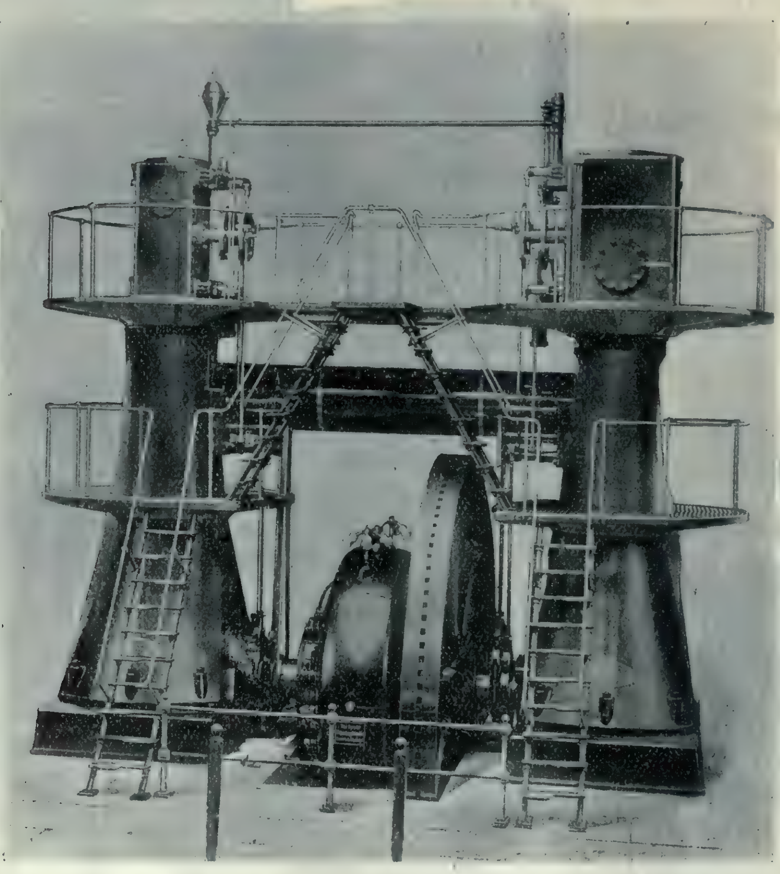

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| Exhaust Outlet, diameter | 13 in. |
| Main Bearings, diameter | 14 in. |
| Main Bearings, length | 24 in. |
| Piston rod, diameter | 3½ in. |
| Crosshead Pin, diameter and length | 6½ in. by 6½ in. |
| Crank Pin, diameter and length | 7 in. by 7 in. |
| Bore of Crosshead Guide | 24 in. |

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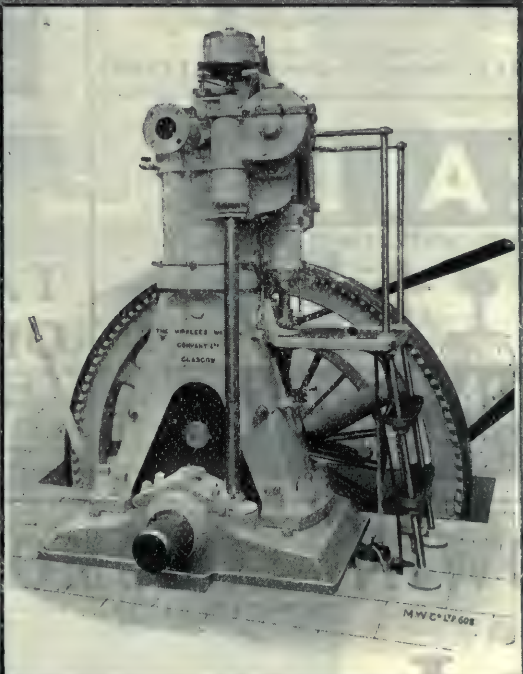

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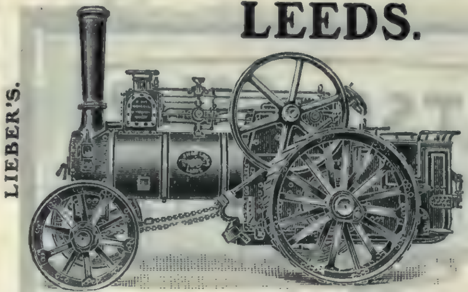

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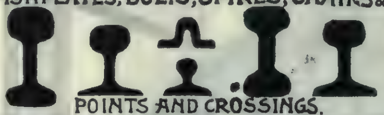

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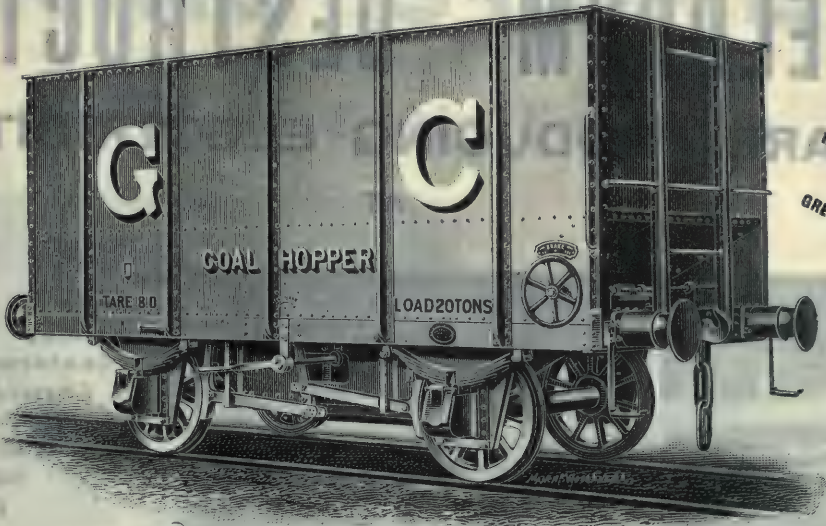

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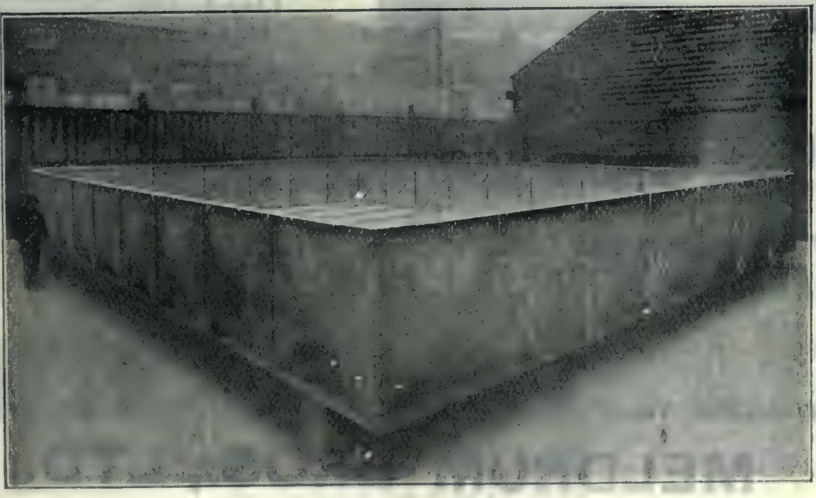

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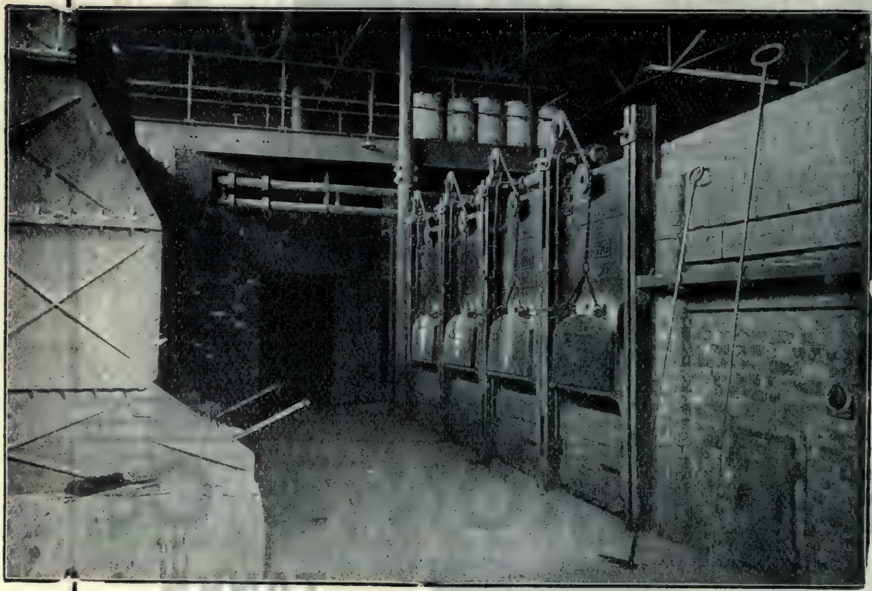

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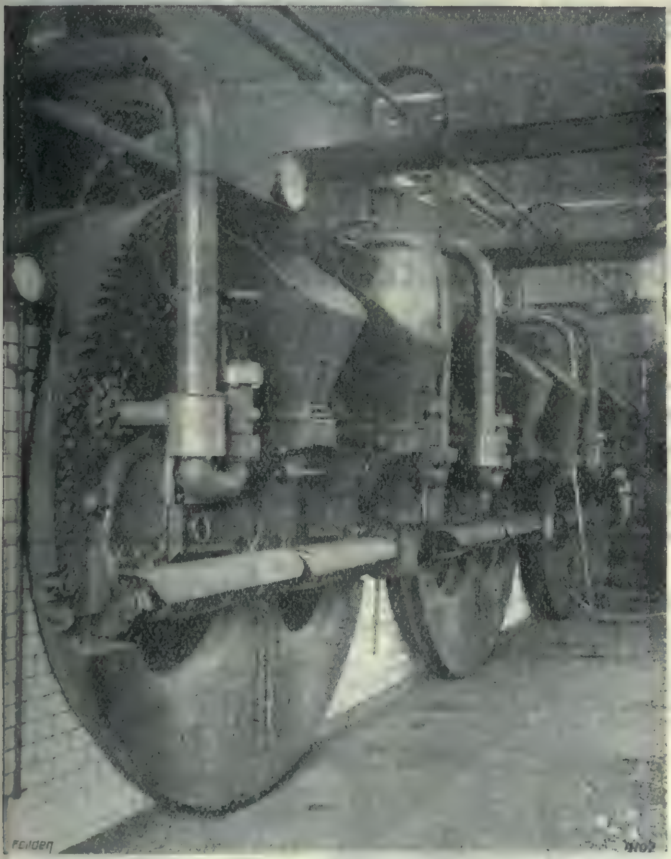

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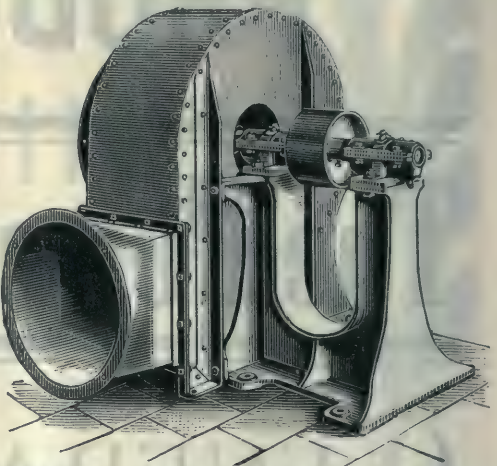

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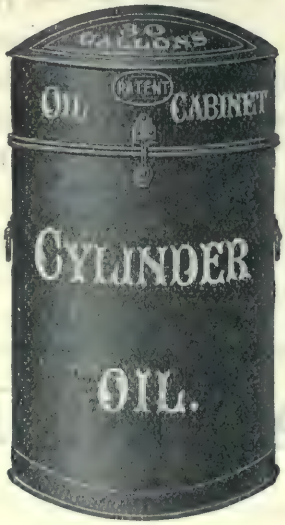

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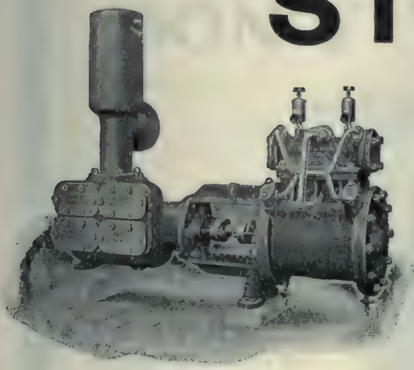

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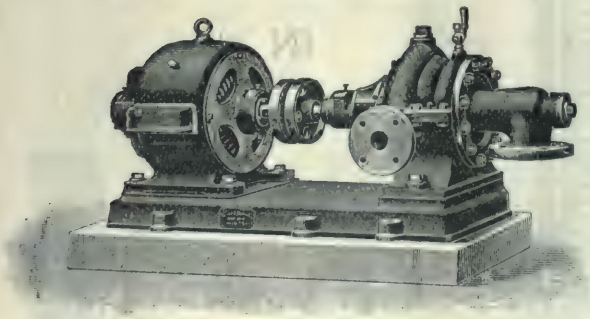

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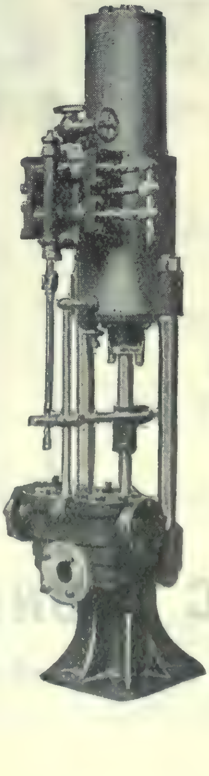

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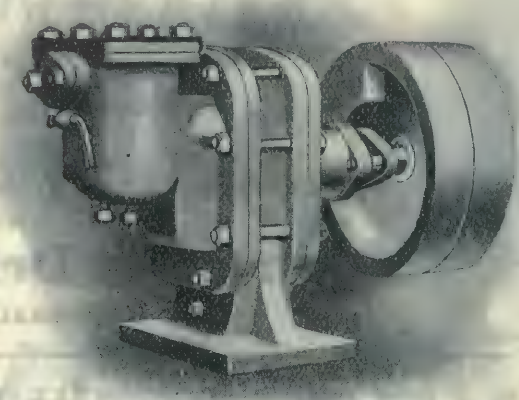

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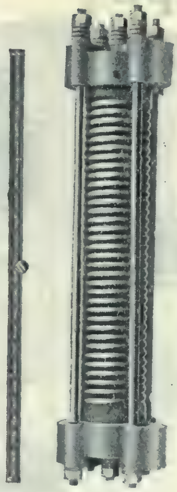

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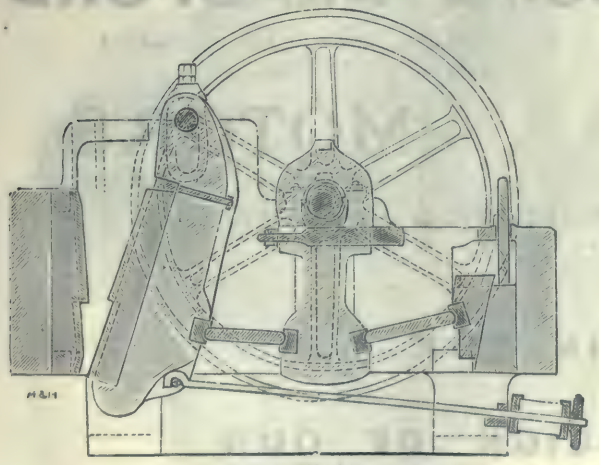

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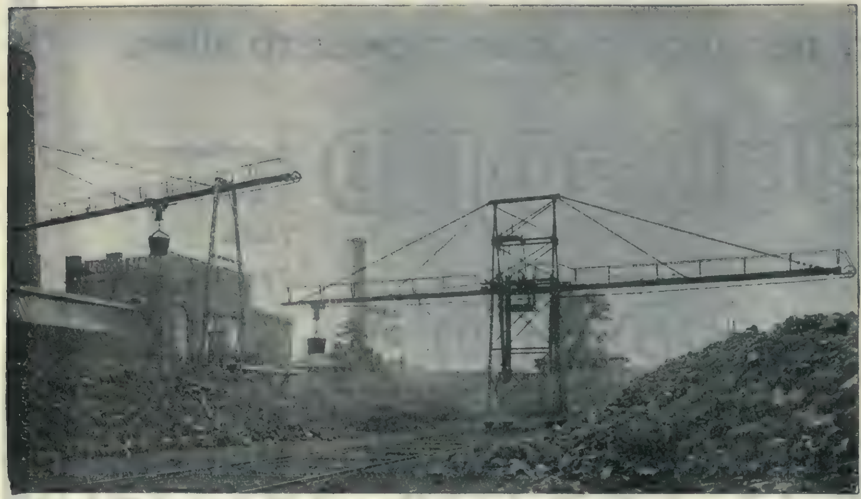

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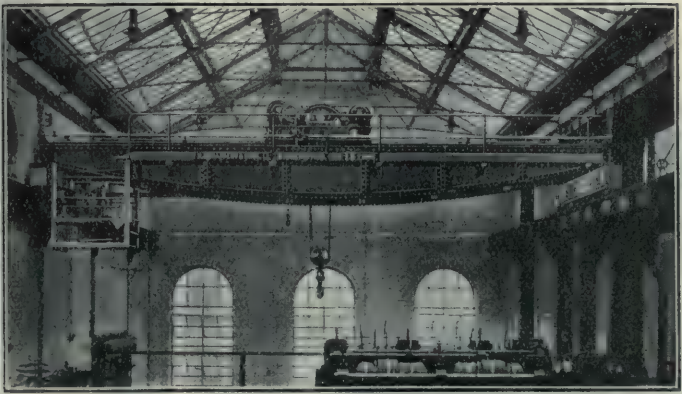

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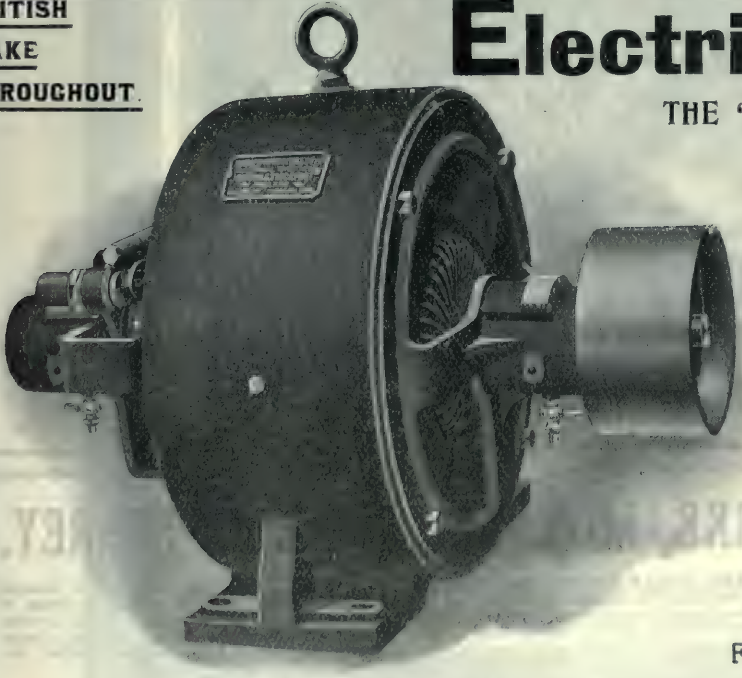

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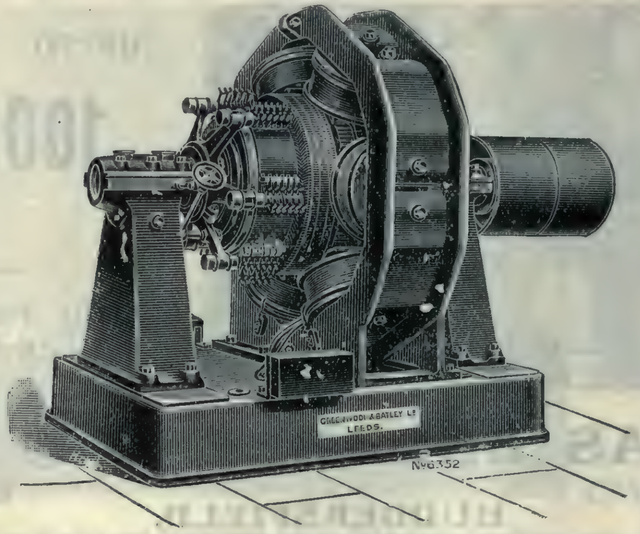

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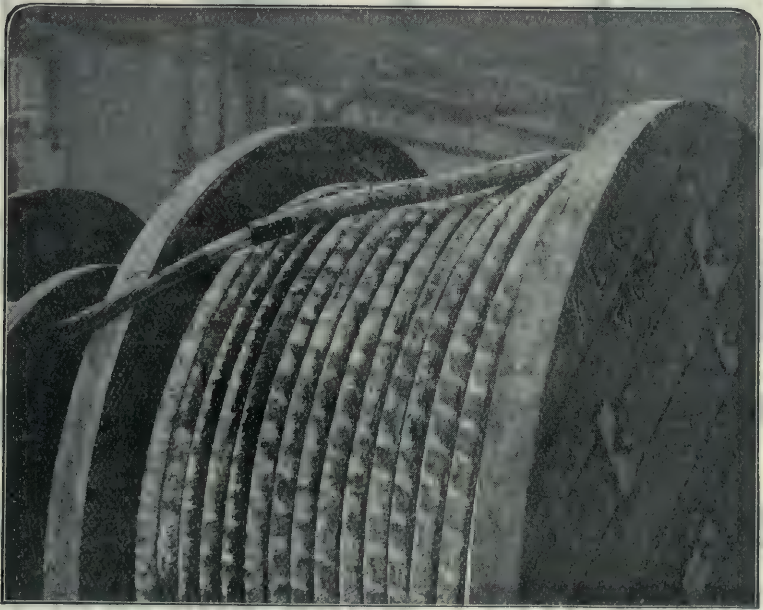

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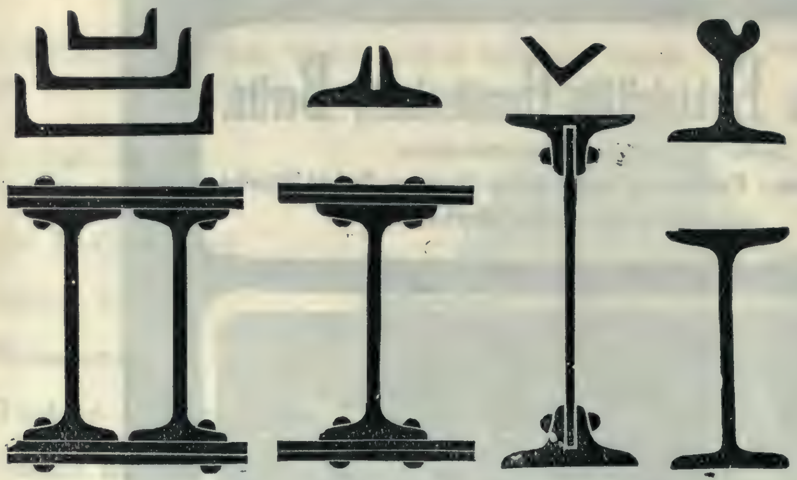

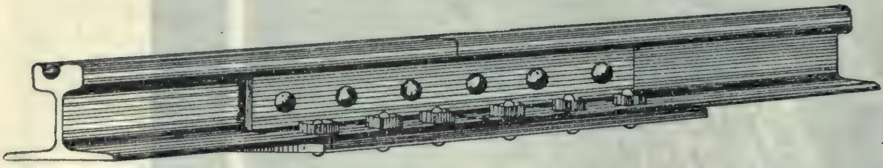

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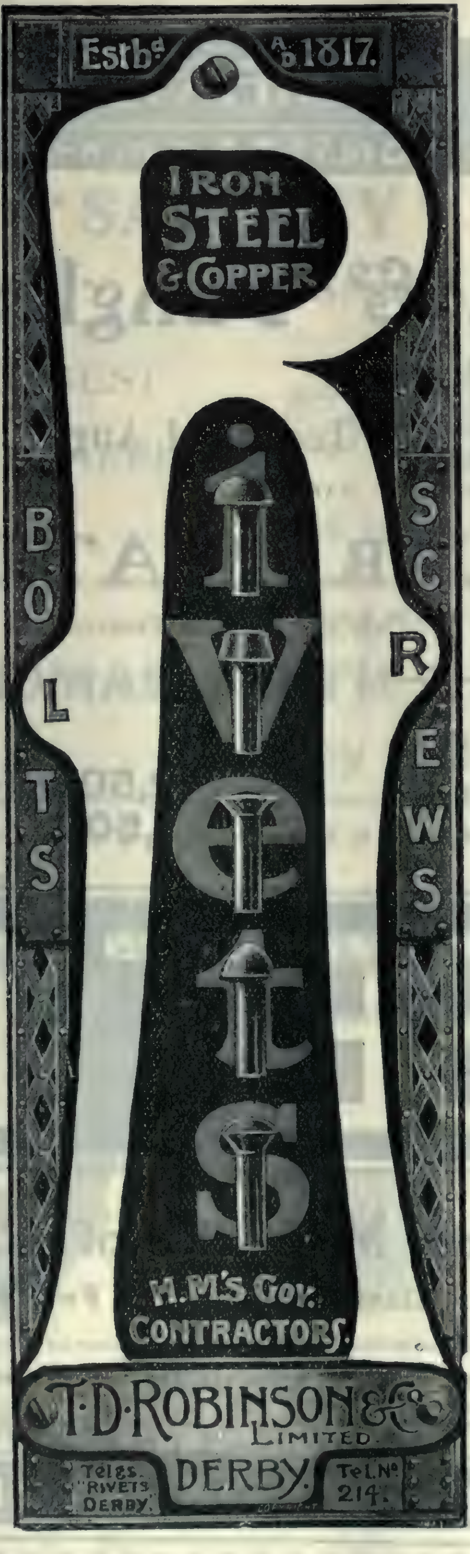

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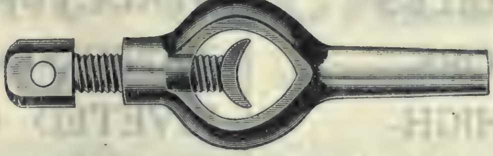

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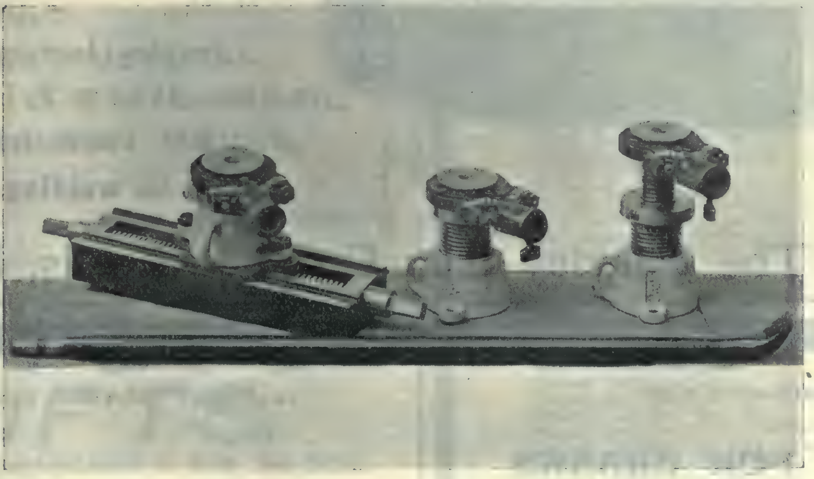

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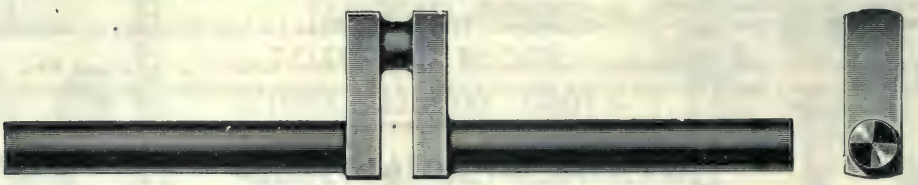

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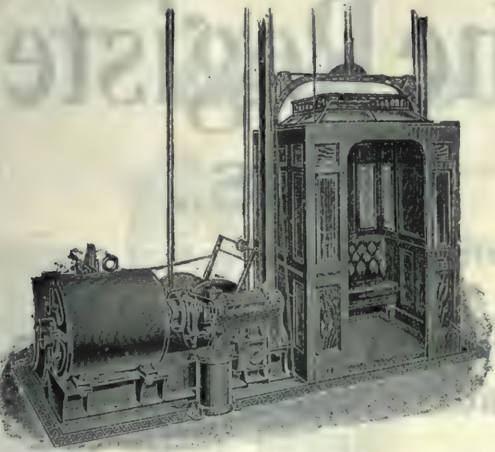

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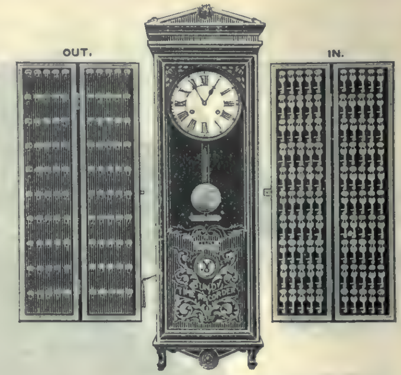

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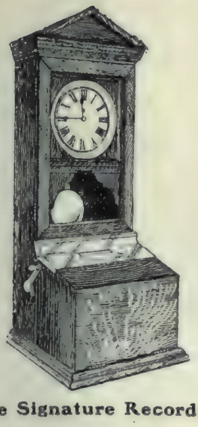

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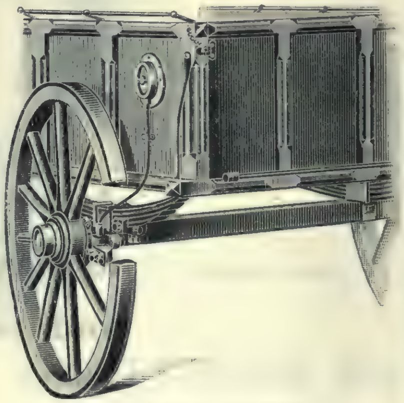

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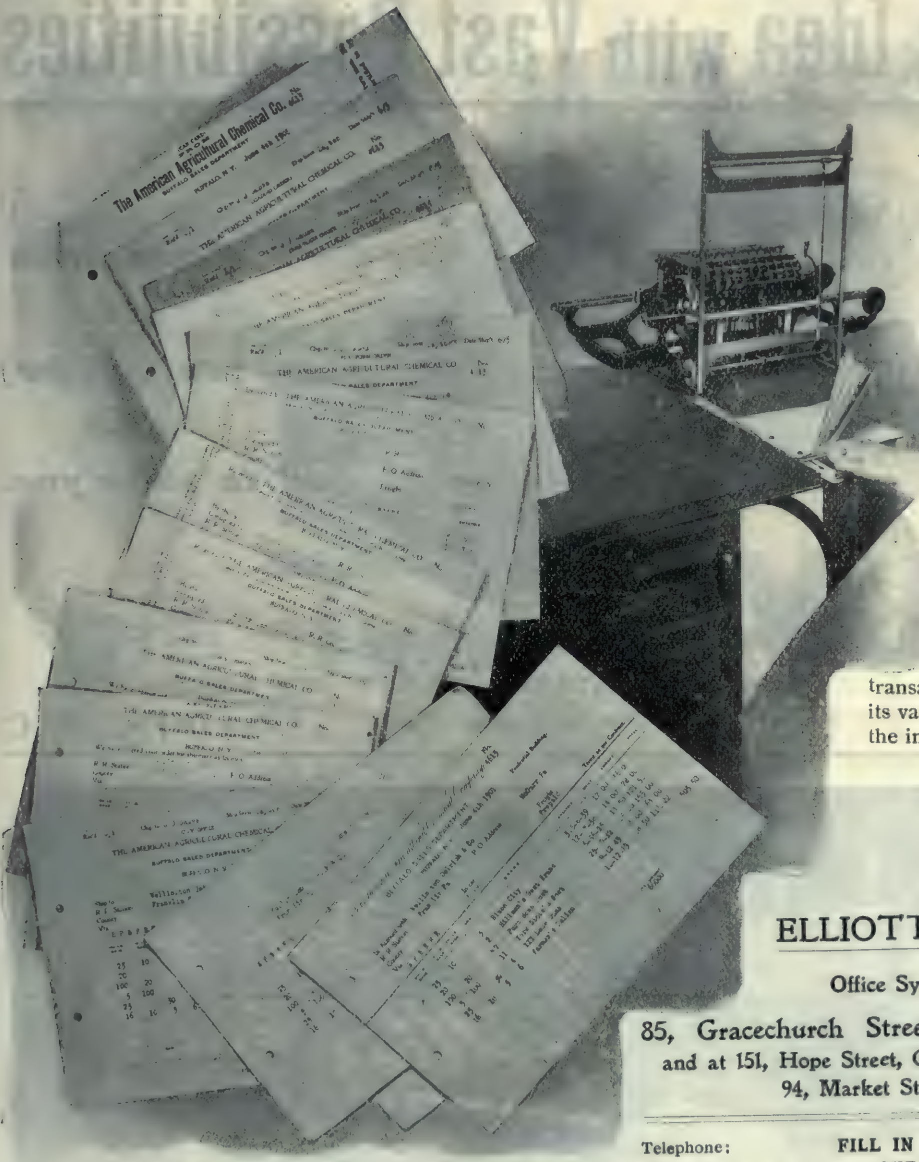

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This illustration shows **13** Records of differently printed forms, varying in size, taking in every transaction, from the order with its various departmental copies to the invoice and wagon label.

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Name.....................................................
Business.................................................
Date 1905. Address..................................................

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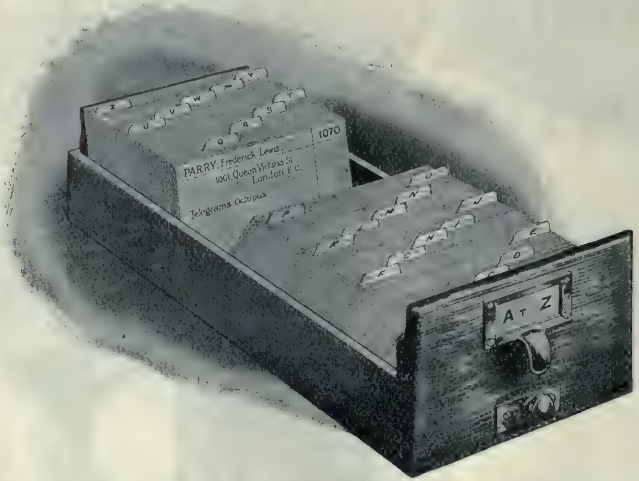

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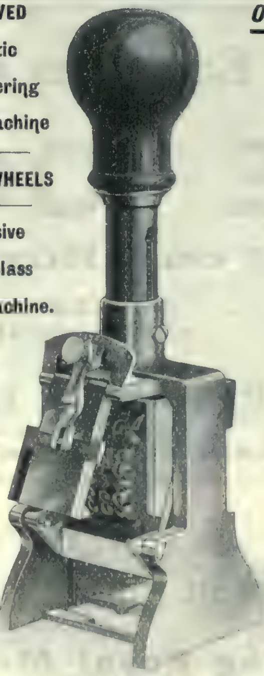

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| †* 9.50 a.m. | For CALAIS only ... ... | | |
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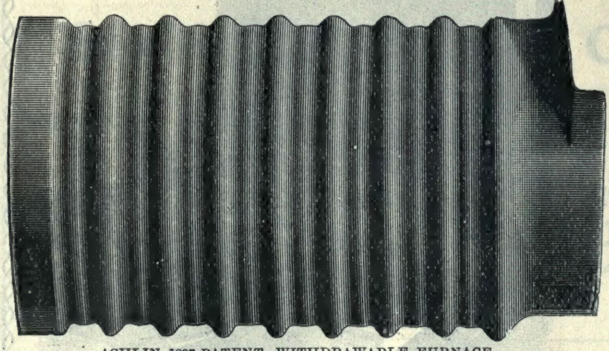

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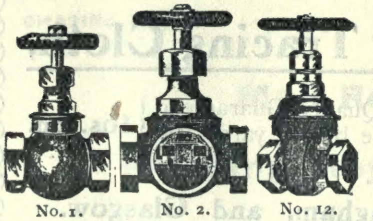

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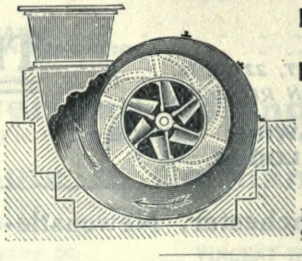

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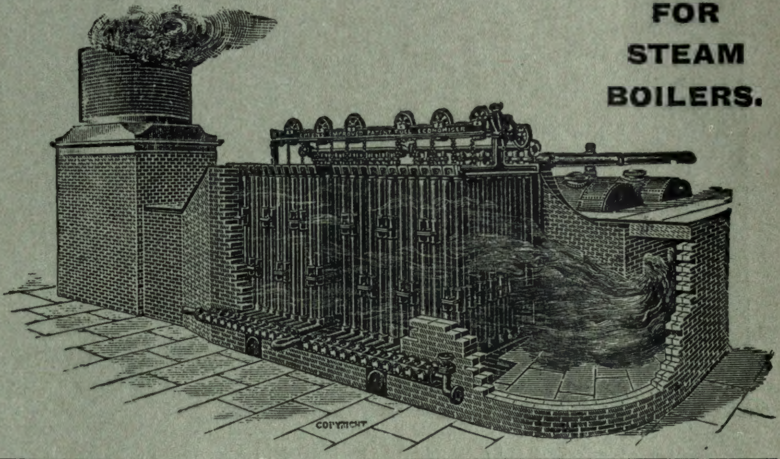

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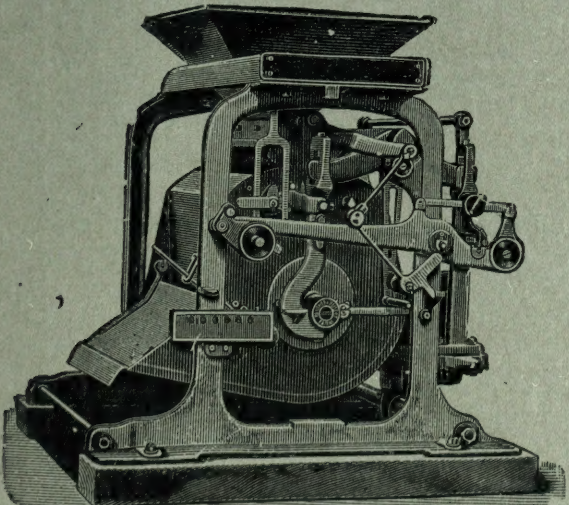

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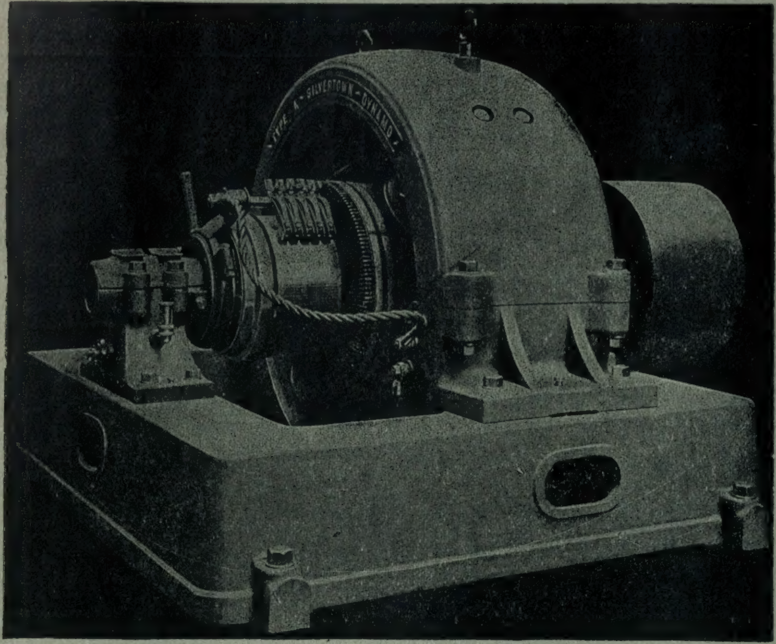

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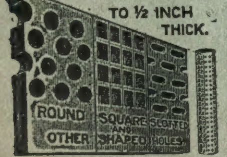

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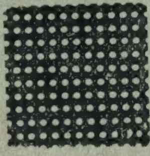

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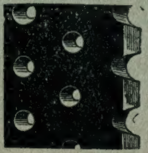

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